U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS.
IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION.

SOIL SURVEY OF TARRANT COUNTY, TEXAS.

BY

H. W. HAWKER, IN CHARGE, AND NEAL GEARREALD,
OF THE TEXAS AGRICULTURAL EXPERIMENT STATION,
AND M. W. BECK, OF THE U. S. DEPARTMENT
OF AGRICULTURE.

[Advance Sheets—Field Operations of the Bureau of Soils, 1920.]

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1924.

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[PUBLIC RESOLUTION—No. 9.]

JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided,* That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]

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SOIL SURVEY OF TARRANT COUNTY, TEXAS.

By H. W. HAWKER, in Charge, and NEAL GEARREALD, of the Texas Agricultural Experiment Station, and M. W. BECK, of the U. S. Department of Agriculture.

DESCRIPTION OF THE AREA.

Tarrant County is situated in the northeastern part of Texas in the third tier of counties south of the Red River, which forms the northern boundary of the State. The central part of the county lies about 80 miles south of the river. The distance to Galveston, on the Gulf of Mexico, is about 280 miles, and the distance to Texarkana, on the east boundary of the State, is approximately 200 miles. Dallas, the principal city in northeast Texas, is about 35 miles east of Fort Worth, in the central part of Tarrant County. The county is approximately 30 miles square and has an area of 884 square miles, or 565,760 acres.

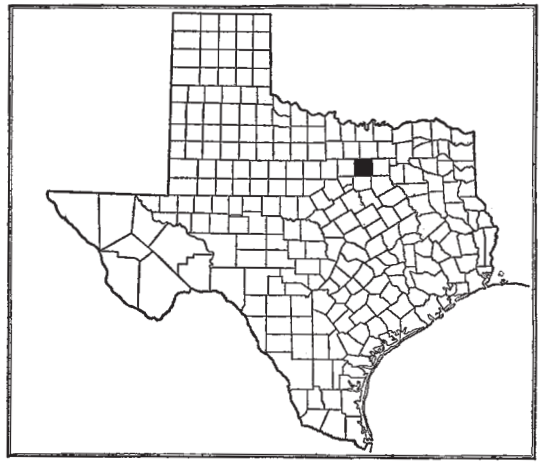


FIG. 26.—Sketch map showing location of the Tarrant County area, Texas.

Physiographically the area included within the county boundaries is a plain sloping eastward. The elevation of the undissected parts of the plain along the western side of the county is a little less than 1,000 feet and along the eastern side a little more than 500 feet above sea level. The eastward slope is approximately uniform.

The dissection of this plain varies somewhat in different parts of the region, and to this is due the varying character of the relief.

A belt lying along the western side of the county is most intricately and most deeply dissected, owing in part to the greater elevation of the plain in this section of the county and in part to the fact that the two forks of Trinity River, the largest streams in the county, traverse it. East of this belt lies a north and south belt that is relatively smooth, the western side entering the county a short distance east of the southwest corner, running northeastward to Fort Worth, thence northwestward and north to the county line 7 or 8 miles east of the northwestern corner. This belt is about 10 miles wide.

East of this lies another belt of more thorough dissection but much smoother than along the west side of the county. This belt continues eastward to the eastern boundary of the county, becoming progressively smoother, so that the eastern border, some 3 to 5 miles wide, is as smooth if not smoother than the Fort Worth belt.

The distribution of native vegetation in Tarrant County is characteristic and has a close relation to the distribution of belts of varying relief. The county is traversed by four north-and-south belts, each distinguishable from the adjoining belts by a different kind of native vegetation. They were noted by the earliest travelers in the region and have been recognized from early times as the most characteristic natural features of this part of Texas. They are much more noticeable than the topographic features. These belts are commonly known by the terms West Cross Timbers, Grand Prairie (the local development being known as the Fort Worth Prairie), East Cross Timbers, and Black Prairie.[1] They occur from west to east in the order named above. In extent of area as they occur in Tarrant County they rank as follows: Grand Prairie, East Cross Timbers, Black Prairie, and West Cross Timbers. In addition there are the alluvial terraces and first bottoms of the streams which traverse or have their origin within the county. The terraces may be subdivided into high terraces and low terraces.

The West Cross Timbers occurs in the northwest part of the county, where it occupies a small area, not over 25 square miles, dissected by the West Fork of the Trinity River. The remainder of the western part of the county, to a line extending south from Fort Worth and northeast through a point 2 miles east of Keller, is in the Grand Prairie or short-grass region. East of this and extending to a line drawn from Mansfield to Arlington and thence to Grapevine, occurs the East Cross Timbers. The Black Prairie occupies the remainder of the upland of the county to the eastward.

The entire drainage of Tarrant County finds its way ultimately into Trinity River. The Clear Fork of Trinity River, which flows into the West Fork of Trinity River at Fort Worth, and the latter, which continues eastward to join the Trinity River in Dallas County, are the principal streams. Normally they range in width from 100 to 300 feet or more, but during flood time their entire first bottoms, in places nearly 2 miles wide, are flooded to a depth of several feet. During the summer the water may barely cover the bottom of the channel. The channels are shallow and in places tortuous. Denton Creek receives the greater part of the drainage from the northern part of the county. This creek flows into the Elm Fork of Trinity River in Dallas County. The drainage from the southern part of

[1] These names are used by geologists in describing the geography of the Texas region, as the character of the native vegetation constitutes a very conspicuous feature of any region, and in this region general geological formations are, in a measure, outlined by the variations in the original plant growth. The latter is also closely related to the soils. The geology of the region in which Tarrant County lies is discussed in detail by R. T. Hill in the twenty-first annual report of the U. S. Geological Survey. The prairies are covered with a heavy growth of native mesquite and other short grasses, with some of the bunch grasses, of which sedge grass or bluestem (*Andropogon* sp.) predominates. The timbered belts where uncleared have a heavy growth of small trees consisting mainly of post oak and blackjack oak. The stream bottoms throughout the timbered uplands and prairies are heavily forested with elm, hackberry, pecan, spotted oak, bur oak, and other trees of less importance. On the prairies an occasional clump of elm or hackberry trees occurs, and a solitary small mesquite tree is sometimes seen.

the county is carried by Walnut Creek and Mountain Creek, both streams of considerable size. In ordinary seasons these streams are intermittent. Some small springs are found along the creeks, but not of a size sufficient to make the streams perennial. Springs are rare in the county as a whole.

The width of the bottoms varies, depending on the size of streams and character of the country traversed by them. The broadest bottoms are those along the two branches of the Trinity. Village Creek, Denton Creek, Walnut Creek, and Mountain Creek have bottoms ranging from 100 feet to one-half mile or more in width. The first bottom along the West Fork of Trinity River is 2½ miles wide near Hurst. The terrace along the river near the east county boundary is 3 miles wide on each side of the bottoms. The elevation of the terrace here averages between 500 and 550 feet, while that of the bottom is 450 feet. At Fort Worth the first bottom is 500 feet in elevation, while the terrace lies between 550 and 600 feet.

At a point 8 miles northwest of Fort Worth the West Fork of Trinity River has been dammed to provide an artificial reservoir for the city. This has given rise to a lake of considerable size, Lake Worth, owing to flooding of the first bottom. Its length is approximately 12 miles and its width from two-fifths mile to 1⅓ miles. Hurst and Calloway Lakes occupy old stream channels in the present bottoms.

A feature of the topography of the county is the occurrence on the Grand Prairie of outliers in mound form of material of the East Cross Timbers, elevated 50 to 100 feet or more above this plain. Notable examples occur near Keller and Crowley. Brushy Mound, south of Crowley and outside the county, is a typical example. Small outliers of the East Cross Timbers also occur on the river terraces, particularly near Euless.

At the close of the war with Mexico Gen. Winfield Scott sent a troop of Cavalry to northern Texas to protect the sparsely settled communities from the Indians. This troop established a post on the Trinity River, at the present site of Fort Worth. The post was first called Camp Worth and was established in June, 1849. Around this post was built up the city of Fort Worth.[2] Settlement of the county had, however, begun in the eastern part considerably earlier. These settlers came from other parts of Texas and from other eastern and southern States. The first settlements were made between 1835 and 1840, according to the best available information. Tarrant County was created by the legislature in 1849, from Navarro County, with the county seat at Birdville, which at that time was larger than Fort Worth. In 1860 the county seat was changed to Fort Worth. The settlement of the county was hampered by the Indians, who frequently raided the settlements. Their removal to the Indian Territory in 1873 was followed by increased immigration.

According to the United States census, the population of Tarrant County in 1870 was 5,788; in 1880, 24,671; in 1890, 41,142; in 1900, 52,376; in 1910, 108,572; and in 1920, 152,800. Growth has thus been rather rapid. Of the 1920 population, 82 per cent is classed as native

[2] Much of the early history of Tarrant County is taken from Early Days in Fort Worth, by B. B. Paddock.

white, 5.7 per cent as foreign-born white, and 12.3 per cent as negro. The city of Fort Worth has represented in it nearly all nationalities among its foreign-born population, Mexicans leading and Russians and Germans coming next in order.

Fort Worth is the principal city. In 1920 its population was 106,482, an increase of 33,170 since 1910. Its chief industry centers about the meat-packing establishments and stockyards. The city also contains large flouring mills, manufacturing plants, and other industrial enterprises. Arlington, Grapevine, and Mansfield are among the more progressive small towns, with populations, according to the 1920 census, of 3,031, 821, and 719, respectively. A great number of trading points are scattered advantageously over the county, Crowley, Keller, Birdville, and Kennedale probably being the chief of these.

As early as 1872 the westward line of the Texas & Pacific Railway was surveyed to Fort Worth. The financial depression of 1873 caused a delay in its construction, and it was not until 1876 that the line was completed to Fort Worth. Other railroads soon followed, among them the Gulf, Colorado & Santa Fe; the Missouri, Kansas & Texas; and the Fort Worth & Rio Grande. The county is now served by nine steam railroads and two interurban lines, all of which enter the city of Fort Worth, making it one of the leading railroad centers of Texas. In addition it is served by a belt railway. Very few parts of the county are over 5 miles from a railroad.

Fort Worth is the center of a comprehensive system of wagon roads, all of modern construction, which extend to all parts of the county. The Bankhead Highway traverses Tarrant County from east to west, passing through Arlington and Fort Worth. Present plans (1920) call for extensive road work through the county, involving improvements that will cost nearly $4,000,000. Road-building material lies close at hand in three forms—water-laid gravel, fragments of ferruginous sandstone, and limestone which can be crushed for this purpose. The dirt roads are kept in good repair by grading and dragging. During the wet season, however, these are frequently impassable, especially in the black-land sections.

Rural free delivery of mail and the telephone reach all parts of the county.

The educational system of the county as a whole leaves little to be desired. The rural schools are mainly of good type. A number of districts are consolidated and have school buildings of excellent construction, containing two to four rooms and modern equipment. In the city of Fort Worth there are a number of colleges. At Arlington is located Grubbs Vocational College, a branch of the Agricultural and Mechanical College of Texas, supplemented by an experimental farm of 100 acres.

The farm water supply is good in all parts of the county, and may be obtained at depths ranging from 50 to 200 feet. Artesian water is obtained in some parts of the county at depths ranging from 400 to 1,000 feet or more.

The chief markets for the county are Fort Worth and Dallas, the latter deriving trade from the eastern part of the county.

CLIMATE.

The climate of Tarrant County, from a temperature standpoint, may be said to be characteristic of the general region in which it is located. The summers are long, and frequently extended periods of hot dry weather occur, mainly during July and August. The summer weather is tempered generally by Gulf breezes, which are cool and pleasant. The winters are short and are not unpleasant, except for the occurrence of "northers," or cold spells, accompanied by strong north and northwest winds. These generally moderate in three or four days. They are sometimes accompanied by rain, rarely by snow. They occur suddenly, and temperature drops of 30° F. or more in a few hours are not uncommon. Both spring and fall are pleasant seasons.

The records of the Weather Bureau stations at Fort Worth and at Grapevine, both of which are within the area, have been drawn on in compiling the tables given in subsequent pages. The records of the former show a maximum temperature of 112° F. occurring in the month of August, and a minimum of —8° F. in February. The mean annual temperature is 65° F.; that of winter, 46.6° F.; of spring, 65° F.; of summer, 82.2° F.; and that of fall, 66° F. The records at Grapevine agree closely with the above.

The average date of the last killing frost in spring is March 10 and of the first in fall November 20, giving an average growing season of 254 days, which is sufficient for all crops grown in the region. The latest spring frost of record occurred on May 1, and the earliest in fall on October 22.

In the matter of precipitation the conditions in the eastern part of the county, represented by the records of Grapevine, are quite different from those around Fort Worth and farther west, the rainfall decreasing from east to west. The mean annual precipitation at Grapevine is 33.35 inches and at Fort Worth 26.89 inches.

The rainfall is distributed through the year, but somewhat unevenly, the seasonal means ranging from 6.03 inches in winter to 11.21 inches in spring at Grapevine and from 3.42 inches to 8.56 inches for the same seasons at Fort Worth. In the driest year recorded at Forth Worth (1910) there was only 17.97 inches of rainfall, and at Grapevine (1909) but 20.26 inches. In the wettest year at Fort Worth (1889) the precipitation reached 47.61 inches and at Grapevine (1908) 50.90 inches.

The average depth of snow at Fort Worth is 3.3 inches per year. This occurs scattered through the winter season as light snows, which melt as soon as they fall, or disappear in a few days.

The following tables give the normal monthly, seasonal, and annual temperature and precipitation at Fort Worth and Grapevine in detail by months:

Normal monthly, seasonal, and annual temperature and precipitation at Fort Worth.

[Elevation, 670 feet.]

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1910).	Total amount for the wettest year (1889).	Snow, average depth.
	°F.	°F.	°F.	Inches.	Inches.	Inches.	Inches.
December	47.5	83	9	1.22	1.23	0.00	0 9
January	44.3	93	1	.93	1.36	5.03	.7
February	48.1	96	−8	1.27	1.14	2.92	.9
Winter	46.6	96	−8	3.42	3.73	7.95	2.5
March	56.6	100	22	1.76	1.02	2.81	T.
April	65.3	97	30	2.65	2.65	3.52	.0
May	73.2	103	34	4.15	5.76	4.91	.0
Spring	65.0	103	22	8.56	9.43	11.24	T.
June	80.1	105	48	2.97	1.38	3.46	.0
July	83.7	109	56	3.04	.14	14.01	.0
August	82.9	112	55	1.87	.26	.72	.0
Summer	82.2	112	48	7.88	1.78	18.19	.0
September	76.7	104	40	2.95	2.21	3.72	.0
October	66.3	98	31	2.51	.68	1.95	.0
November	55.1	87	20	1.57	.14	4.56	.8
Fall	66.0	104	20	7.03	3.03	10.23	.8
Year	65.0	112	−8	26.89	17.97	47.61	3.3

Normal monthly, seasonal, and annual temperature and precipitation at Grapevine.

[Elevation, 670 feet.]

Month.	Temperature.			Precipitation.			
	Mean.	Absolute maximum.	Absolute minimum.	Mean.	Total amount for the driest year (1909).	Total amount for the wettest year (1908).	Snow, average depth.
	°F.	°F.	°F.	Inches.	Inches.	Inches.	Inches.
December	47.3	84	5	2.43	3.56	0.09	1.0
January	46.0	95	2	1.81	.20	.98	2.4
February	47.3	93	−12	1.79	.96	3.07	1.2
Winter	46.9	95	−12	6.03	4.72	4.14	4.6
March	58.2	100	18	2.98	.82	3.89	T.
April	65.6	95	29	3.73	2.20	11.37	.0
May	72.9	105	40	4.50	.63	11.30	.0
Spring	65.6	105	18	11.21	3.65	26.56	T.
June	80.2	109	47	3.32	3.65	4.80	.0
July	83.3	112	50	3.18	.77	3.26	.0
August	84.3	108	50	1.75	.63	2.50	.0
Summer	82.6	112	47	8.25	5.05	10.56	.0
September	77.3	106	42	2.58	.72	2.32	.0
October	67.8	102	22	2.75	2.55	5.15	.0
November	56.4	89	16	2.53	3.57	2.17	T.
Fall	67.2	106	16	7.86	6.84	9.64	T.
Year	65.6	112	−12	33.35	20.26	50.90	4.6

AGRICULTURE.

The agriculture practiced by the early white settlers was on the rich forested bottom lands and the forested uplands adgacent. The presence of more or less unfriendly Indians and the proximity of fuel, water, and timber for building purposes were factors which influenced the settlers to seek the timberlands. Furthermore, the prairie lands were at first regarded as unproductive, as they did not support forest trees. They were, however, used for pasturing cattle, and owing to the great extent of prairie land in the county, cattle raising became more and more important. Later this industry was given a decided impetus by the location of packing houses in Fort Worth. Agriculture has always been and is still the leading industry in Tarrant County.

The early settlers grew only those products that were essential to subsistence, as the markets were distant and the demand limited. These crops consisted chiefly of wheat for flour, sorghum for feed and sirup, oats and hay for feed, and vegetables of the garden patches. Cotton had to be transported long distances to market, and very little was grown. Cattle, which could be driven to market, entered more largely into trade. The building of the railroads and the increase of settlement opened up new markets both within and outside the county and greatly stimulated agriculture and cattle raising. When the true value of the prairie lands for crop production became known large areas previously used only as a free range were brought into use, and large areas of upland were brought under private ownership and fenced.

The table below, giving the acreage and production of the leading field crops, as reported by the last five Federal censuses, shows the trend of agriculture in the county in the last 40 years:

Acreage and production of the leading crops in 1879, 1889, 1899, 1909, and 1919.

Year.	Corn.		Oats.		Wheat.		Hay and forage.		Cotton.	
	Acres.	Bushels.	Acres.	Bushels.	Acres.	Bushels.	Acres.	Tons.	Acres.	Bales.
1879	38,496	429,118	7,055	153,671	26,481	193,673	2,410	1,717	27,821	10,950
1889	45,978	1,013,766	14,268	291,328	29,611	297,563	13,975	16,665	28,364	6,524
1899	59,244	1,609,080	18,784	576,090	65,248	843,320	16,833	18,398	44,528	16,190
1909	41,550	372,601	3,327	28,687	7,432	56,090	10,276	5,229	75,938	11,580
1919	32,029	892,554	28,195	891,004	41,205	463,466	18,583	31,994	72,444	18,020

These figures show that cotton and corn have been the leading crops during the period covered. Cotton nearly trebled in acreage during the period from 1879 to 1909, and on the whole shows the most consistent increase. The area in corn has fluctuated widely, and the acreages of oats and wheat also show similar changes.

The present agriculture may be divided into four types: (1) General farming; (2) cattle and hog raising; (3) dairying; (4) truck growing.

Cotton still is the chief crop of the county and the leading cash crop as well. Cotton has been increasingly difficult to raise at a profit owing to the ravages of the boll weevil and bollworm, but to this time (1922) there has been little decline in acreage. Among a

number of varieties grown Mebane, Rowden, and Half and Half are important. (Pl. VI, fig. 1.)

Corn is the crop of second importance. Some corn is grown on nearly all farms to supply grain and forage for work stock and other farm animals. It is also used to some extent for silage. The principal varieties are Ferguson Yellow Dent, Surecropper, and Shoepeg. Of the June varieties, White Pearl is probably the favorite.

Rye and barley are grown on very small acreages, and in some years they may not be grown at all.

Peanuts were first returned in the census for 1889, when 6 acres produced 277 bushels. By 1919 the acreage had increased to 2,835 acres, with a total yield of 43,695 bushels. The Spanish is the chief variety, the acreage devoted to varieties of the Virginia type being very small. In addition to the nuts, the crop is valued for the vines, which are used as hay, and for the improvement of the soil. (Pl. VII, fig. 2.)

Broomcorn is becoming an important crop in the eastern part of the county, the product going largely to a broom factory at Dalworth, 2 miles east of the county line. It is estimated that 350 acres were devoted to broom corn in 1920. All of this was planted to the standard Evergreen variety. In good seasons a second crop is harvested. (Pl. IX, fig. 1.)

Oats rank third in acreage in the county as a rule. Texas Rust Proof is the variety almost universally grown. The greater part of this crop is grown upon the prairie lands in the northeastern, southeastern, and western parts of the county. (Pl. VI, fig. 2.) Most of the oat crop is used locally for feed.

The production of wheat is confined almost entirely to the prairie sections of the county. Until 1900 the production of wheat steadily increased, but after that a great reduction was caused by insect devastation, crop failures, and the importation of northern and western wheat. Mediterranean is the favorite variety in the county, but Turkey is grown in some sections. (Pl. VII, fig. 1.)

The total acreage of hay and forage crops reported for 1919 includes 4,141 acres of tame hay, 3,047 acres of wild hay, 2,068 acres of small grains cut for hay, 674 acres of annual legumes, 8,277 acres of kafir and other sorghums cut for forage, and a few acres of silage crops and of corn cut for forage. Alfalfa was introduced between 1890 and 1900, being reported as growing on 34 acres in 1899, and yielding 67 tons, and on 241 acres in 1909, yielding 153 tons.[3] Sudan grass[4] is being grown with good success in various parts of the county. It is generally sown in rows with a drill. As a rule two cuttings are made and the yields range from 1 to 3 tons per acre. Johnson grass is much in evidence on the calcareous soils of the county. This is also used for hay. Cowpea hay should be grown more in the county, since this crop has great value as a soil builder. On the sandy lands it could be combined with the prevalent crab grass of that section to make a very palatable hay for horses and cattle.

There is considerable market gardening and dairying in the vicinity of Fort Worth along the main highways leading into that

[3] Alfalfa was not reported separately in 1919.
[4] See Farmers' Bulletin No. 605, U. S. Dept. Agr.

city, and in the eastern part of the county along the old Fort Worth and Dallas Road. This form of agriculture has increased largely since 1900 in a ratio commensurate with the growth of the cities.

Of the 29,081 cattle reported by the census in the county on January 1, 1920, 15,893 are classed as dairy cattle and 10,195 of these as cows or heifers 2 years old and over. The dairymen have been very successful in building up their herds in recent years. Over 400 registered dairy cattle were brought into the county in 1920. The leading breeds of dairy cattle, according to observation, appear to be the Jersey and Holstein, with only a few Guernsey. There are some exceptionally fine herds of Holstein and Jersey animals in the county. The value of dairy products in 1919, exclusive of home use of milk and cream, is reported by the census as $881,514.

The poultry industry is also of considerable importance. The value of poultry and eggs produced in 1919 was $332,209.

Most of the farms devoted to market gardening and trucking are in the vicinity of Fort Worth. In some instances the crops are grown under irrigation. The produce from these farms is sold not only in Fort Worth and Dallas and other local markets but is shipped to northern and eastern cities. Among the crops grown are watermelons, muskmelons, tomatoes, cabbage, asparagus, black-eyed peas, sweet potatoes, potatoes, lettuce, peas, and turnips. The census of 1920 shows 106 acres devoted to potatoes in 1919, producing 7,344 bushels; 928 acres of sweet potatoes and yams, producing 92,713 bushels; and 1,526 acres devoted to other vegetables.

The chief varieties of watermelons are Tom Watson (grown largely for shipping), Georgia Rattlesnake, and Mean's Delicious. Of muskmelons the Rocky Ford and Little Gem are favorites, some Osage also being grown. (Pl. VIII, fig. 1.) Standard varieties of garden vegetables are produced, each grower having a preference. Of the sweet potatoes the Nancy Hall leads, and of "yams" the Porto Rico and Pumpkin are the favorites. (Pl. VIII, fig. 2.) The value of vegetables raised in Tarrant County in 1919 was $434,716.

The production of small fruit in Tarrant County is important and is increasing yearly. The chief small fruits are blackberries and dewberries. In 1909 the combined acreage of these fruits was 86 acres and in 1919, 381 acres. The production in the latter year reached 419,275 quarts. The leading varieties of blackberries are the Dallas, McDonald, and Wonder. Of dewberries the Austin is the chief variety. Some strawberries are grown, but mainly for home use. Peaches are the most important among the orchard fruits. The census of 1920 reports 70,307 peach trees of bearing age, with a production of 68,268 bushels; 8,189 pear trees, yielding 16,286 bushels; 15,694 plum and prune trees, yielding 12,733 bushels; and 3,449 apple trees, producing 2,869 bushels. Orchard fruits are grown mainly for home use, there being only a few commercial orchards.

Elberta and Early Wheeler are the favorite varieties of peaches, though other varieties are grown. The Kieffer pear seems to be best suited to the climatic conditions of this region and is also more resistant to blight than other varieties of pears. Of plums, the Golden, Gonzales, and Wild Goose are most common in the county. A few apricot trees were observed, the Golden Drop being considered best.

The production of pecans in the county also deserves mention. The majority of the trees are native seedlings, which have received little or no attention until recently. Effort is being made, with some success, to introduce the paper-shell varieties and to have the native varieties budded or top worked. The varieties advocated for this section, in order of their preference, are the Halbert, Burkett, and Stuart.

The beef-cattle industry of the county is important, especially on the prairie lands in the western part of the county. Large numbers of cattle also are found in the rough areas of sandy land adjacent to the river and larger creeks. The Hereford breed is easily the leader, with Shorthorn second, Red Poll third. There are also a few Aberdeen Angus. Tarrant County has been cleared of the fever tick.

The leading breeds of hogs are the Duroc-Jersey, big-boned Poland-China, and Hampshire, in that order, with a few Tamworth and Ohio Improved Chester. There are in the county several large pure-bred herds. Owing to considerable precautional and educational work hog cholera is scarce.

Some attention is paid to the raising of high-grade horses, mainly of the draft type, the Percheron being the chief breed. Mules are also raised commercially, but are absorbed mainly in the local markets.

In this county there is a close relation between the different soils and the crops grown upon them. These different relations, however, are as yet of a general nature and attach to the four divisions or provinces in which these soils occur, rather than to the individual soil types. In other words, they have not as yet been worked out in any great degree of refinement. This relationship is, however, recognized to some extent by the farmers, especially on farms that contain both the sandy soils of the Cross Timbers and the heavy soils of the prairies. Peanuts are grown on the sandy soils and broom corn upon the brown prairie lands. It is recognized also that wheat and oats do better on the heavy prairie soils and that the truck crops do best on the sandy soils. Corn does better on the heavy soils, and when the farmer has his choice he generally makes use of the heavy soils of the prairies for this crop. Cotton is grown on nearly all lands, except that it is rarely planted on the deeper sandy soils. For corn in the Cross Timbers a loamy soil of medium depth with a semi-friable or friable subsoil is preferred. Rough stony land, and those areas of bottom land so frequently overflowed as to make agriculture unsafe, are used for pastures, as are also the areas of Denton clay, shallow phase, which in most seasons would prove droughty if cultivated. The Houston clay and the San Saba clay are regarded as the strongest of the upland soils. The Bell clay is a highly productive terrace type. When the spring season is warm and dry the sandy soils are preferred for cotton, as they allow early planting, which is helpful in avoiding damage by the boll weevil and bollworm. For trucking the loamy sandy soils of the stream terraces are preferred, especially the Amite fine sandy loam; and this is also chosen for small-fruit production.

The majority of the farmers in Tarrant County are well supplied with modern farm machinery, though in some of the poorer sections the equipment leaves considerable to be desired. Tractors are numer-

ous, especially on the flat prairie, where large fields of nearly level land are common, and as a rule improved types of machinery are used with the tractors. Horses and mules are generally above the average. Dwellings and outbuildings are fair to good, and the general appearance of farm yards may be said to be above the average.

Methods of cultivation necessarily vary, each farmer using methods according to equipment and his judgment and often varying the cultivation of a particular tract. This is especially true of sandy lands, where crops are sometimes sowed in the furrow or on ridges, depending on the crop and the season. The general method of preparing land for cotton consists of bedding and rebedding. Sweeps and middle busters are generally used to throw up the beds, the position of the middles of the rows being changed from year to year, the new bed taking the place of the old middle. Sometimes a turning plow is used for bedding. Land for corn is sometimes flat broken, although as a rule it is prepared as for cotton. In order to conserve moisture the land is frequently harrowed or dragged during the winter and early spring.

Corn is planted usually from March 15 to April 15, and "June corn" as late as July 15. Cotton is planted as early as April 1 and may be planted as late as June. Corn is cultivated three or four times and cotton from three to six, depending on the season. Wheat and oats are commonly drilled in, the usual period of seeding extending from September 15 to October 15. Both grains are pastured during the fall and early spring. Most of the sorghum is broadcasted or drilled in and is cut for hay when 2 to 3 feet high. Some of it is used for silage or sirup making, in which case it is usually planted in rows like corn. Peanuts and sweet potatoes may be planted in ridges or on a flat surface, ridged up when cultivating. Broom corn is drilled in rows 3½ to 4 feet apart.

The farmers of Tarrant County as a rule do not follow any special rotation of crops. Though realizing that crop rotation would be of benefit, the same crops too often are planted year after year on the same field. This is true especially in the sandy land sections. Most farmers, however, make a change in the crops planted in a certain field from time to time. Very little commercial fertilizer is used in the county and barnyard manure only where intensive market gardening is done.

Farm labor recently has been scarce. This is due to the nearness of the cities of Fort Worth and Dallas and to the attraction of labor to the oil fields. The farmer has not been able lately to compete with these centers in the hire of labor. In the oil fields especially the wage paid for unskilled labor is high, making it difficult for farmers to obtain good tenants. Farm laborers are generally colored or Mexican. Considerable labor is performed by the day, at rates of $3 a day and upward. Wages by the month vary from $50 to $75, with board. Cotton picking is generally paid for at the rate of $1.50 to $3 per 100 pounds, depending on crop conditions.

Farms vary in size from holdings of 40 to 640 acres or more. The average size of the farms in 1920 was 118.5 acres, of which about 64 per cent was classed as improved land. Most of the large tracts are located in the western part of the county and consist of lands used largely for grazing.

Of the 3,336 farms in Tarrant County in 1920, 49.2 per cent were operated by tenants, 49.6 per cent by owners, and 1.2 per cent by managers. The percentage of lands operated by owners has decreased gradually from 58.72 per cent in 1890.

Tenure of rented farms is largely annual. The rental consists of one-half of the crops when the owner furnishes seed and equipment, and one-fourth of cotton and one-third of other crops when seed and equipment are furnished by the tenant. Lands leased for broomcorn in the eastern part of the county are operated under special contracts with the broom company.

Farm values vary greatly, being enhanced by nearness to markets, proximity to Fort Worth (for residential purposes), improvements, and location on good roads. The character of the soil is also an important factor in values, the "black lands" being considered far superior to the sandy lands. Strictly agricultural lands in the black prairie of the eastern part of the county range in price from $150 to $300 an acre, in the sandy sections in the central part of the county from $50 to $150, in the prairie sections in the western part of the county from $50 to $150 or $200, and in the stream bottoms from $50 to $150 an acre.

Irrigation is used to some extent in growing vegetables, both in the first bottoms and on the terraces. The individual projects are for the most part small, covering tracts of not more than 10 to 20 acres. On the terraces water is supplied from reservoirs filled by pumping from wells in the adjacent first bottoms. The total cost of such installations is not large, and the practice undoubtedly could be extended profitably. In the vicinity of Randols Mill water is pumped directly into mains from the West Fork of Trinity River.

Cotton-root rot is prevalent in the county, large spots occurring in the fields where the plants have wilted and died before maturing.

Alkali conditions exist in some small spots on the heavier lands of the county where the drainage is especially poor. This is manifested generally by the presence of a white incrustation on the surface following the evaporation of standing water. Analysis shows the presence in these areas of sulphate and chloride of magnesia and chloride of soda in sufficient quantities to injure ordinary farm crops.[5] The remedy lies in establishing proper drainage and in loosening the soil by the incorporation of coarse manures and litter. Crops less sensitive to alkali, such as oats, should be grown on these areas at first.

The Fort Worth stockyards are the potential source of a large quantity of stable manure. This can be obtained at a very reasonable cost, and much greater advantage should be taken of the opportunity by the farmers of the county.

The United States Department of Agriculture, the extension service of the Agricultural and Mechanical College of Texas, and the Fort Worth Chamber of Commerce maintain at Fort Worth an agricultural demonstration agent and assistants for the purpose of assisting in the agricultural development of the county. The chief lines of endeavor of this agency are (1) the development of crops suited to various types of soil, (2) general introduction of purebred livestock, (3) development in the county of a more in-

[5] Report of Analysis No. 17710. Texas Agr. Expt. Sta.

FIG. 1.—COTTON ON SAN SABA CLAY.

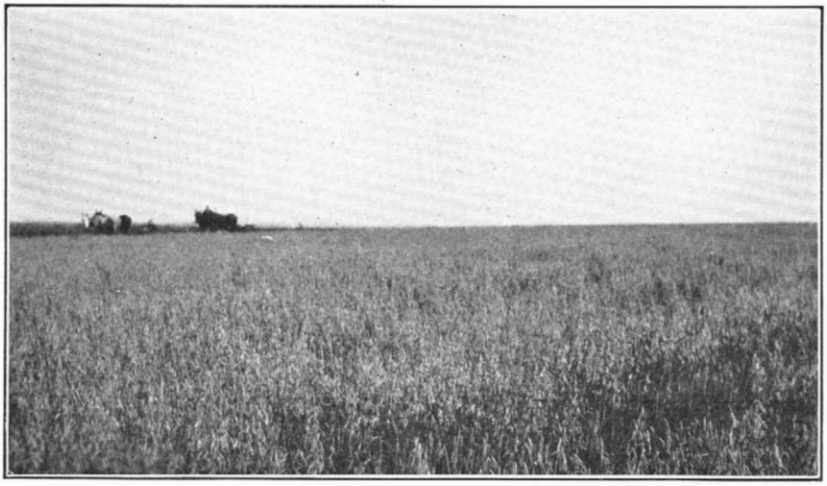


FIG. 2.—OATS ON HOUSTON BLACK CLAY.

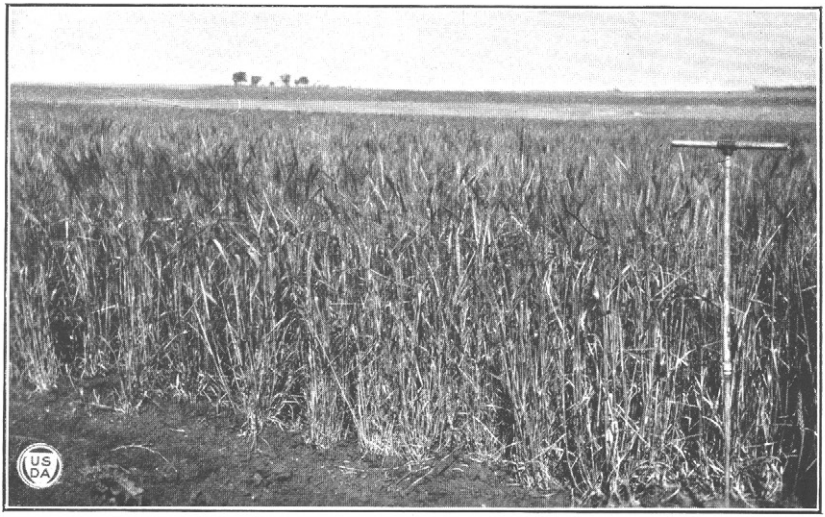


FIG. 1.—WHEAT ON HOUSTON BLACK CLAY.

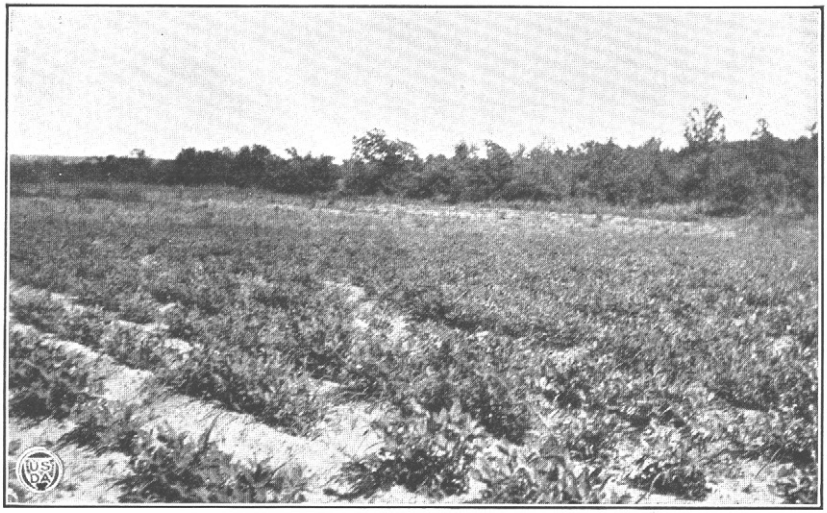


FIG. 2.—PEANUTS ON KIRVEN FINE SANDY LOAM, DEEP PHASE.

FIG. 1.—ROCKY FORD MUSKMELONS ON AMITE FINE SANDY LOAM.

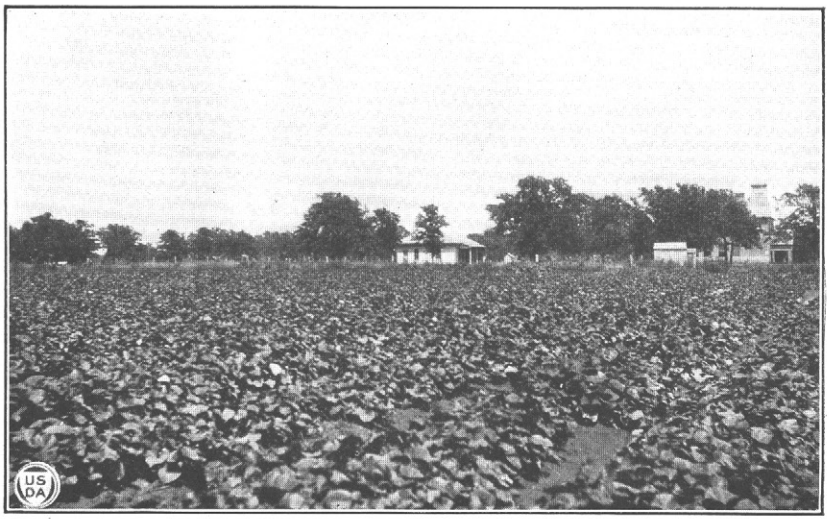


FIG. 2.—SWEET POTATOES ON KIRVEN FINE SANDY LOAM.

FIG. 1.—BROOM CORN ON HOUSTON BLACK CLAY.

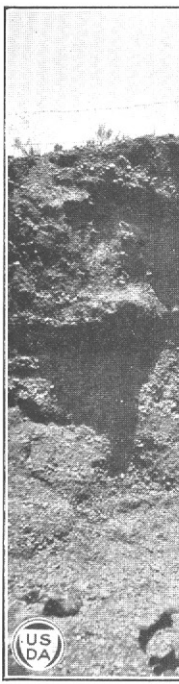


FIG. 2.—CONC
UNDERLYIN

tensive agriculture, the greater production of fruits, nuts, and berries, and (4) boys' club work in crops and livestock. A home economics branch is also maintained at Fort Worth, the chief lines of endeavor of which are (1) poultry, (2) canning, (3) service, and the establishment of women's and girls' clubs for these purposes.

Several practices are recommended which are applicable to the county as a whole: (1) The terracing of those lands which, because of their slope and the character of the soil, are susceptible to erosion; (2) the practice of crop rotation to keep up fertility; (3) the growing of leguminous crops in rotation, as the growing of cowpeas in corn, to build up nitrogen content and organic supply of the soil; (4) the use of green and barnyard manures to increase the supply of plant food; (5) deeper tillage to bring new soil to the surface and to increase the depth of the moisture-holding layer; and (6) frequent cultivation and mulching of surface in clean cultivated crops to retain moisture.

SOILS.

The soils of Tarrant County range in color from dense black to gray and in texture from heavy clay to sand. On the basis of color as well as of texture, in a general way at least, the soils of the county may be grouped into an area of dark to black soils in the Black Prairie belt, occupying the eastern part of the county; a belt of light-colored soils, in the East Cross Timbers belt; another belt of predominantly dark-colored soils, in the Fort Worth Prairie; and a second belt of light-colored soils in the West Cross Timbers area, in the northwestern part of the county. This series of soil belts includes both the upland soils and those on the river terraces, but the soils in the river flood plains correspond only approximately to those of the belts adjoining. The sketch map (fig. 27) gives roughly the position and extent of these several groups of soils.

The belts of prairie and timber, described roughly on a preceding page as corresponding to the soil belts just mentioned, are not entirely uniform in their characteristics, since the prairie belts especially are interrupted here and there by areas of timber, and within the latter the soils are lighter in color than where the prairie is uninterrupted.

The soils of the prairies are usually calcareous at relatively shallow depth, ranging from a few inches to somewhat more than 3 feet. The lime carbonate in these subsoils is, however, not what is known in soil literature as "soil lime." This expression is used to designate lime carbonate that has formed in the soil as carbonate by the combination of calcium previously existing there in some form other than carbonate with carbon dioxide derived either from the organic matter of the soil or from the air, carried in either case in the soil water. This kind of lime is found in the soils of regions with lower rainfall than that of Tarrant County.

The lime carbonate in Tarrant County soils is what may be called "geological lime," this expression designating lime that is present in the rocks from which the soils have been or are being developed.

The soils of the Black Prairie region have been derived from a soft chalky material and the depth to this material ranges from a few

inches up to 3 feet or more. The depth is gradually increasing where the surface is not being lowered by erosion, through the dissolving action of the soil waters.

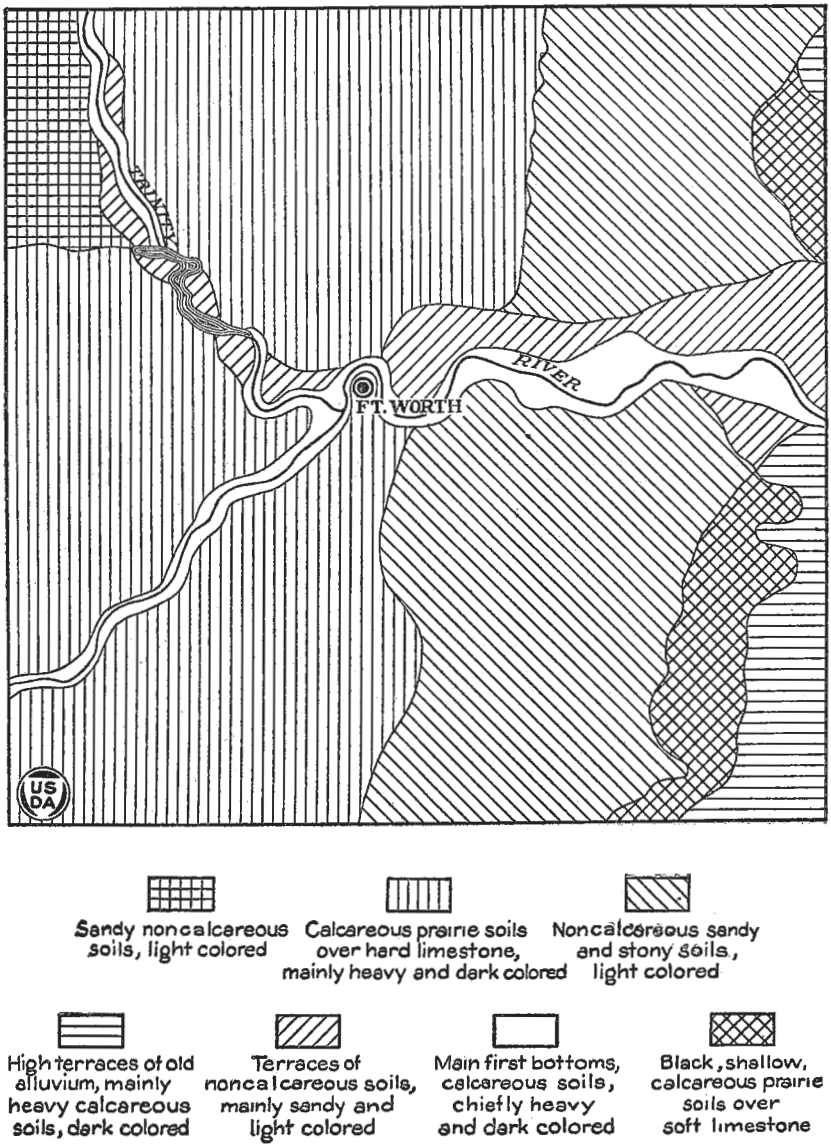


FIG. 27.—Sketch map showing the main soil divisions of Tarrant County.

The soils of the Fort Worth Prairie have been derived in part from soft chalky material, but mainly from rather hard limestones. Those soils derived from the chalky or marly material are a good deal like those of the Black Prairie belt, having a soft, chalky lime carbonate at rather shallow depth. Those soils derived from the

hard limestones do not usually have soft, chalky lime carbonate at shallow depth. They usually lie on the hard limestones and contain as a rule either not enough lime carbonate to effervesce in acid or else only a thin layer of strongly calcareous soil.

Those soils in the river valleys that have accumulated by the deposition of sediment from the Black Prairie soils are black in color, but do not have, as a rule, a layer of lime carbonate in the subsoil. The same may be said of the old alluvial soils derived from the same source.

Those soils in the river valleys accumulated by deposition of material from the soils of the Fort Worth Prairie are dark colored also. The streams, however, have distributed limestone gravel over their alluvial valleys, so that these alluvial soils, both from the recent and old alluvium, are usually underlain by gravel beds.

The soils of the timber belts are light in color in the surface and range from yellow to red in the subsoil. There is some range in the color of the surface soil, but not so much as in the subsoil.

Those soils having a red subsoil apparently have reached the most advanced stage of weathering and oxidation, though this does not necessarily imply an advanced age. Where drainage conditions are such as to permit thorough aeration and oxidation, and the soil occupies a position protected from erosion—that is, a level area—so that it is permitted to weather thoroughly, in places well-oxidized or red soils have been formed. The most advanced soils in point of weathering in Tarrant County are those of the Amite, Kirvin, Crawford, Durant, and Windthorst series, all of which have subsoils of red color. Next in degree of weathering are the soils with brown or yellow subsoils—the Lewisville, Kalmia, Tabor, Denton, Nimrod, and Norfolk.

According to the classification developed by the Bureau of Soils, the soils are separated on the basis of differences in the vertical soil section or upper soil section, usually 3 feet deep. A soil series consists of soils that are similar in color, structure, lime content or the absence thereof, presence or absence of excessive water-soluble salts, mode of formation, and in the case of alluvial soils, in position with respect to overflow. Each series is divided into soil types, which differ from one another in texture, or the proportions of clay, silt, and sand particles making up the surface soil.

The Durant series includes types with dull-red to brownish-red soils, overlying dull-red, red, or brownish-red subsoils, and there is usually present varying amounts of brownish and reddish ferruginous material in the soil and subsoil. The exact origin of the Durant series is not clear, but it may have been derived from noncalcareous beds. Of the Durant series, the clay loam and fine sandy loam types are mapped in Tarrant County.

The soils of the Crawford series, represented here by a comparatively small area of the clay type, are also red to reddish brown, with rather stiff red clay subsoils, calcareous in the lower depths.

The Denton soils are derived from limestone. These have dark-brown to brown soils overlying subsoils of brown color. Of this series the clay and shallow phase of the clay are mapped.

The San Saba soils are derived from the same kind of limestone as the Denton soils, but they are not so well drained as the Denton.

The San Saba soils are black at the surface, and the subsoil is black to dark gray. Only one type, the clay, is mapped in Tarrant County.

The Wilson soils resemble the San Saba soils. Both surface soil and subsoil vary in color from dark gray to black. They are typically developed in the prairie region, and are noncalcareous, having been derived from noncalcareous material or having had their lime carbonates leached out to depths below the 3-foot section. The clay and clay loam types are mapped in Tarrant County. The natural drainage is not perfect.

In the Black Prairie limy shales have weathered into the Houston series, represented by two types, the black clay and the clay. The series includes black to brown soils, overlying a calcareous subsoil varying from black and brown to olive colored. The brown Houston clay occurs on slopes where erosion is sufficiently active to prevent the degree of weathering and oxidation and the accumulation of organic matter occurring in the flatter areas of the black clay.

The Ellis clay occurs in the southeastern part of the county, on the prominent escarpment at the edge of the Austin chalk, which passes northward into Dallas and southward into Ellis county. It is a brown to olive-colored clay overlying olive-colored or greenish-yellow clay, usually noncalcareous. It is derived from shales of low lime content.

Only two series, the Windthorst and Nimrod, are developed in the West Cross Timbers. Both of them are noncalcareous. The Windthorst series is represented by one type, the fine sandy loam, and consists of grayish-brown soils overlying a red subsoil which is usually stiff and often mottled with yellow in the lower part. The Nimrod series also has only one type in Tarrant County, the fine sand. This is a grayish-brown fine sand overlying pale-yellow or yellowish-gray fine sand.

In the East Cross Timbers region four series occur—the Kirvin, Tabor, Lufkin, and Norfolk. All of these are noncalcareous in the 3-foot section.

The Kirvin includes types with grayish-brown to reddish-brown soils, and a subsoil of brownish-red to deep-red color, and rather stiff structure. This series is represented in Tarrant County by the fine sandy loam, and the flat, stony, deep, and eroded phases of this type.

The Tabor series, represented by the fine sandy loam, includes types with gray to brownish-gray soils overlying a yellow or mottled gray and yellow, fairly plastic to plastic subsoil.

The Lufkin series, of which the fine sandy loam only was mapped, consists of types with gray to dark-gray soils overlying a subsoil of gray or mottled gray and yellowish color. The Lufkin is the poorest drained of these East Cross Timbers series, and the Tabor is next in this respect.

The types in the Norfolk series have grayish-brown soils, and yellow friable subsoils. The fine sand type of this series only is mapped.

The alluvial soils of Tarrant County represent nearly as many series as do the upland soils, although the total area of alluvial soils is probably only from 10 to 15 per cent of the total area of the county. The alluvial soils occur as high terraces, lower terraces, and first bottoms.

The high terraces represent the highest of the old alluvial soils of the county. The greatest development of these is along the Tarrant-Dallas County line south of the West Fork of Trinity River. The Lewisville, Bell, and Irving series represent relatively old stream-deposited material, as evidenced by the beds of stratified gravel present in many places in the substratum. The Lewisville and Irving series were first mapped on an extension of this high terrace, north of the West Fork of Trinity River, in Dallas County. Of these three series, the Lewisville and Bell are calcareous and the Irving is non-calcareous.

The types in the Lewisville series have brown to dark-brown soils and a brown subsoil. They occupy generally areas of undulating topography. The clay and two phases, a reddish-brown and an eroded phase, are mapped, the latter representing areas especially subject to erosion.

The Bell soils are black and are underlain by a black to bluish-black subsoil. The topography is generally level. A single type, the clay, is mapped in this survey.

The Irving series includes types with surface soils of dark ashy gray color, overlying a subsoil of ashy-gray color. They occupy imperfectly drained flats and are not calcareous. One type, the clay, is mapped.

The other terrace soils are of the Simmons, Leaf, Kalmia, and Amite series. Of these, the Simmons series has a calcareous subsoil.

The Simmons series includes soils of black color, with a subsoil of black, bluish-black, or dark-gray color. One member of the series, the clay, is mapped. A "concrete" layer consisting of gravel, mostly limestone, cemented into a conglomerate by calcium carbonate, is generally present, but because of the level topography it is rarely exposed.

The Amite series, represented here by the fine sandy loam with two phases, includes soils of grayish-brown to reddish color overlying a friable subsoil of brownish red to red. The subsoil of this series is somewhat stiffer than the subsoil of the more typical Amite soils mapped along streams farther east in the Coastal Plain. Another difference is the presence of limestone gravel in the gravelly substratum, where such substratum is present, which is not found in the gravelly substratum of the typical Amite. The Amite and the other associated noncalcareous terrace soils mapped in this area are not thoroughly representative of the main development of these soils farther east. They should be looked upon as the western development of the series. In their features of color, low lime content, and manner of deposition they correspond with the more easterly development, the principal difference being a somewhat stiffer subsoil.

The Kalmia series includes terrace soils of grayish-brown color, overlying a subsoil of yellow or orange-yellow color. They are of low lime content. Two types are mapped, the fine sandy loam and the fine sand.

The types of the Leaf series have surface soils of grayish-brown to brown color, and a plastic subsoil, generally mottled yellow, red, and gray. They are low in lime. Two members of the series occur in Tarrant County, the fine sandy loam and the clay loam.

The soils of recent-alluvial material are included in four series. The Frio series, generally calcareous in the subsoil, comprises types

with grayish-brown to brown or nearly black soils, and a grayish-brown subsoil. The sediments composing the typical Frio soils are derived from the Grand Prairie. The fine sandy loam, loam, and clay members of the series occur in Tarrant County, the clay predominating.

The Trinity series includes the first bottom composed of materials derived from the Black Prairie. The soils are black or jet black, and the subsoil ranges in color from black to bluish gray and is calcareous. The clay member alone is found in this area.

The Catalpa series resembles the Trinity series, except that the color is brown. The clay type is found in Tarrant County.

The Ochlockonee series, as mapped in Tarrant County, includes first-bottom soils ranging from light brown to brown in color, and having a subsoil of light-brown, yellowish, or grayish color. They are not calcareous as a rule. The series is represented by the fine sandy loam.

Rough stony land, as mapped in this county, includes land which is so rough and stony that it is unsuited for agriculture.

In the following pages of this report the various soils are described in detail. Their distribution is shown on the accompanying soil map, and their actual and relative extent is given in the table below:

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Denton clay	105,408	34.9	Durant clay loam	7,616	1.3
Shallow phase	91,968		Rough stony land	7,488	1.3
Kirvin fine sandy loam	64,640	14.4	Norfolk fine sand	6,464	1.1
Deep phase	6,080		Lufkin fine sandy loam	3,712	.6
Flat phase	6,016		Wilson clay loam	3,648	.6
Stony phase	4,032		Ochlockonee fine sandy loam	2,816	.5
Eroded phase	704		Houston clay	2,752	.5
San Saba clay	40,960	7.2	Kalmia fine sandy loam	2,688	.5
Tabor fine sandy loam	37,056	6.5	Frio loam	2,624	.5
Frio clay	32,320	5.7	Leaf clay loam	2,240	.4
Houston black clay	28,352	5.0	Crawford clay	2,176	.4
Amite fine sandy loam	24,384	4.5	Kalmia fine sand	2,112	.4
Colluvial phase	256		Durant fine sandy loam	2,048	.4
Deep phase	192		Simmons clay	1,984	.3
Lewisville clay	21,952	4.1	Nimrod fine sand	1,600	.3
Reddish-brown phase	448		Irving clay	1,600	.3
Eroded phase	320		Wilson clay	1,344	.2
Frio fine sandy loam	11,456	2.0	Catalpa clay	1,280	.2
Leaf fine sandy loam	8,448	1.5	Ellis clay	64	.1
Bell clay	8,320	1.5			
Trinity clay	8,128	1.4	Total	565,760	
Windthorst fine sandy loam	8,064	1.4			

DENTON CLAY.

The soil of the Denton clay consists of about 8 inches of a dark-brown or brown to grayish-brown stiff clay, plastic and sticky when wet and friable when dry. The typical subsoil is a brown or light-brown stiff clay that grades downward into yellowish-brown, brownish-yellow, or yellow stiff clay, locally containing whitish marly material, which in places gives a friable or chalky structure to the lower subsoil. Both soil and subsoil are calcareous, and nodules of calcium carbonate are common, particularly in the latter. The underlying limestone is reached within the 3-foot section on some of the slopes, but usually it lies deeper than 3 feet.

In some places, particularly where the topography is comparatively flat, the soil is darker and deeper, approaching the characteristics of the soil of the San Saba types. The drainage of these areas is not as good as in the areas of more typical material. In small areas the subsoil of the type grades at 24 to 30 inches from the typical yellowish-brown stiff clay into a friable yellowish clay loam, and then into the semichalky limestone rock from which the type is derived. Such areas really constitute the shallow phase of the type, but on account of their small extent they are not mapped separately. As mapped the type includes on some of the slopes stony patches, most of which would have been classified as Denton stony clay, had they been large enough. There are some areas also that have a chocolate-brownish color. These are confined to well-drained situations and represent an approach in character toward the Crawford soils. Some unimportant patches of true Crawford are included with the type.

The topography of the Denton clay is gently sloping to undulating or gently rolling, and both the surface and internal drainage are good. This type is derived from the limestones of the Fort Worth Prairie, in the central and western parts of the county.

The large area of the Denton clay would make it an important type, even were its agricultural value not high. It is, however, next to the San Saba clay, probably the strongest soil of the Fort Worth Prairie. More than 60 per cent of this type is under cultivation. The chief crops are cotton, corn, oats, and wheat. In average years cotton yields from one-third to three-fourths bale; corn, from 25 to 50 bushels; wheat, from 12 to 20 bushels; and oats, from 35 to 50 bushels per acre. Yields considerably larger than these have been obtained. Yields of two-fifths or one-half bale of cotton, 35 bushels of corn, 18 bushels of wheat, and 45 bushels of oats may be considered a normal average. The land not in cultivation is used for pasture and for the production of prairie hay. The type produces a good growth of bluestem and mesquite grasses, which yield from one-third to one-half ton of hay per acre per cutting, two cuttings generally being obtained annually. Sudan grass and sorghum are grown for pasturage and for hay. Both do well with sufficient moisture and may be cut twice in a season, with a yield of 1 to 1½ tons of hay per acre at each cutting.

Draft power and machinery of the heavy type are desirable for efficient cultivation. When wet the soil is sticky and plastic. If cultivated when wet, any clods formed crumble readily with the first rain, as do most limy clays. If plowed when slightly moist, the soil turns readily and on drying crumbles and forms a good tilth.

Land of this type sells for $125 to $225 an acre, depending largely on location and improvements.

Terracing is necessary where the topography is rolling, as the soil is easily eroded. The land in cultivation should be plowed deeply and cultivated often to increase the absorption of moisture and to conserve it under the conditions of moderate rainfall. The grain sorghums, including milo and feterita, are recommended as substitutes for corn both for dry feed and ensilage, since they are better suited to the climatic conditions and rarely fail.

Some bodies of Crockett clay loam have been included with the Denton clay on account of their small extent. This soil consists of brown, dark-brown, or black heavy clay loam to clay, with a depth of about 12 inches, underlain by brown or olive-colored, tough, heavy clay. The brown clay subsoil is mottled with yellow and red, or passes into yellowish-brown clay mottled with red at about 24 inches and may pass into olive-colored clay within the 3-foot limit of the soil profile. The lower subsoil may be calcareous. There are some places where stiff black clay comes to the surface, and in these whitish incrustations appear in dry weather.

This kind of soil occurs in several small areas east of Watauga and in several others along the Arlington-Mansfield Road, at the eastern edge of the East Cross Timbers, adjacent to the Black Prairie. The surface varies from nearly level to undulating. The drainage is fair to good, except in the flattest areas, where alkali crusts appear.

Most of this soil is under cultivation to cotton and corn. Some wheat is grown. Corn yields from 25 to 35 bushels in good seasons, cotton from one-fourth to one-half bale, and wheat probably averages 15 bushels per acre.

Denton clay, shallow phase.—The shallow phase of the Denton clay is a brown to slightly dark-brown clay, underlain at depths ranging from about one-half inch to 6 or 8 inches by yellowish-brown to pale-yellow stiff clay, which passes at depths ranging from about 6 to 12 inches into whitish and yellowish chalky clay with unweathered limestone a few inches below. In places the soil material extends to depths of 2 feet or more, but as a rule it is not possible to bore deeper than 1 foot. Both the soil and subsoil are highly calcareous. The upper part of the subsoil is generally stiff, but in places friable chalky material is reached within a few inches of the surface.

In some small included areas the soil is light brown to grayish in color and very shallow, the parent rock occurring directly underneath. Small fragments of grayish limestone are more or less abundant on the surface and through the soil, being usually very abundant in the subsoil. Many areas do not have fragments on the surface, but either an abundance of them is present in the subsoil or bedrock is reached at shallow depths. In many exposed sections hard limestone is interbedded through the substratum with yellow or greenish-yellow highly calcareous clay, usually containing whitish marly material.

This phase is rather extensive in the county. It occurs mainly in the vicinity of streams, where it occupies the slopes and adjacent uplands. There are also some large nearly level tracts, chief of these being the areas used for the aerial gunnery range north of Fort Worth. The drainage is thorough over most of this phase.

This land is used mainly for pastures, as it is rather too shallow and droughty for good results with most crops. Bluestem and mesquite are the important native grasses. Mesquite trees and sumac grow in many places, and a few oak trees occur along the edges of areas of this soil adjacent to forested lands. As the soil is easily eroded, it should be kept well sodded wherever the topography is sloping.

SAN SABA CLAY.

The soil of the San Saba clay consists of a black calcareous clay, stiffer in the subsoil, and generally passing at 24 to 30 inches into a dark-gray or dark-brown, stiff, calcareous clay, showing some yellowish brown or greenish yellow in places. This lower yellowish subsoil is usually sticky and plastic. Small whitish lime fragments are present in the soil in many places, and occasional lime concretions an inch in diameter are found in this clay; in the lower subsoil such concretions are numerous locally. In places the dark-colored clay extends to depths of more than 3 feet. The parent limestone material is rarely reached within the 3-foot section.

The type has a flat, nearly level topography, which favors the accumulation rather than the removal of soil material. Drainage is poor during wet seasons.

Although the soil is stiff when wet, it crumbles readily and forms a good tilth if cultivated when moderately moist. If plowed when wet, the soil forms clods, but there is a tendency for these to crumble with subsequent rains.

The San Saba clay occurs on the Grand Prairie, or Fort Worth Prairie, as it is designated in Tarrant County. It occupies flat areas on the divides and depressions about the heads of and along small drainage ways. The type is widely developed, occurring throughout the western part of the county. The largest areas are those in the vicinity of Saginaw.

This type is locally called "black land." It is considered a strong, productive soil. On account of its slow drainage, the soil is necessarily late in spring, delaying the planting of cotton. It is best suited to cotton and corn, and most of the land in cultivation is used for these crops. The greater part, probably 80 per cent, is under cultivation.

Cotton yields from two-fifths to three-fifths bale per acre in favorable seasons, and corn from 25 to 40 bushels. Wheat is grown on some of the type, and yields from 12 to 18 or 20 bushels. Oats also are grown, producing about 30 or 35 bushels per acre. Both wheat and oats have a tendency to lodge in wet seasons.

This type is held at $125 to $175 an acre, depending on the location and improvements.

CRAWFORD CLAY.

The Crawford clay consists of a reddish-brown to chocolate-brown clay, grading into brownish-red to reddish-brown stiff or moderately stiff clay, which usually extends without important change to the bedrock, limestone, at depths of about 3 feet or less. In places whitish and yellowish chalky lime material is present in the subsoil, and here and there in the soil. In some areas small, platy fragments of hard limestone are scattered over the surface. The lower subsoil is prevailingly calcareous, and in many places the soil and upper subsoil also.

The type occurs in the Grand Prairie section of the county, and is derived from the same limestone as the Denton soils. The type is not extensive.

The Crawford clay, as mapped, includes several small areas of Crawford clay loam, which differs from the clay only in the texture of the surface soil. Several areas of the typical soil have a subsoil of red to light-red clay. In a few included areas the surface material to a depth of 12 to 20 inches is similar to that giving the Durant clay, the stiffer material giving the Crawford clay appearing in the lower subsoil.

The surface is gently rolling to rolling, the areas occur on stream slopes, and the drainage is good. The type is inclined to be droughty, and the utmost conservation of moisture by means of mulching is necessary for crops during long dry spells. Heavy draft power is necessary for efficient cultivation of the type. The soil crumbles readily if cultivated under proper moisture conditions; it clods if plowed when too wet, but the clods tend to crumble after rain.

This is a productive soil, yielding from two-fifths to three-fifths bale of cotton per acre, or 25 to 30 bushels of corn. Wheat yields from 15 to 18 bushels, and oats from 35 to 40 bushels per acre. Kafir, milo, and feterita do well. Land of this type is valued at $100 to $175 an acre.

WILSON CLAY LOAM.

The soil of the typical Wilson clay loam consists of an ashy-black or black heavy clay loam, underlain at about 5 to 10 inches by black or ashy-black, stiff, heavy clay, which usually shows no change in the 3-foot section, except in color, which in the lower subsoil is brown or dark brown in places. Effervescence with hydrochloric acid is seldom produced on the material within the 3-foot section. Dark-colored iron concretions are present locally in both the soil and subsoil.

The type as mapped is somewhat variable. It includes some areas in which the soil texture is a loam or a silty clay loam, and some in which the color of the surface soil is brown to dark brown. The subsoil of some areas passes from the typical ashy-black into an olive-colored, locally calcareous, heavy clay; in others the subsoil below 24 inches is a noncalcareous, drab, stiff, heavy clay, mottled with brown, yellow, and sometimes red.

The total area of the Wilson clay loam in Tarrant County is not large. The more important areas lie in the vicinity of Village Creek School. The areas in which the soil approaches a loam in texture occur near Smithfield and Keller.

The greater part of this type is under cultivation. In virgin areas it is covered with a heavy growth of mesquite grass, bluestem, and some Bermuda grass, with scattering mesquite trees. The surface of virgin areas is characterized locally by hog wallows. Some of the hummocks contain large proportions of calcareous concretions, indicating the presence of calcareous material at lower depths.

The surface is flat to nearly level, and the drainage is imperfect. Drainage could be improved by laying tile drains, which would also make the type earlier in spring. Cultivation is delayed in wet seasons, owing to the sticky nature of the type when wet. During dry spells the surface cracks badly and injures growing crops. The

soil breaks down readily and a good seed bed results if the land is plowed when it has the proper moisture content.

The greater part of the type is under cultivation. Corn and cotton are the principal crops. Some kafir, milo, and feterita are grown, chiefly for ensilage. Cotton yields from one-fourth to one-half bale per acre; corn, from 25 to 40 bushels; wheat, from 10 to 15 bushels; and oats, from 25 to 40 bushels. The sorghums yield from 8 to 10 tons of silage per acre.

Land of this type sells for $100 to $175 an acre, the price varying with improvements and location.

WILSON CLAY.

The Wilson clay consists of a black to ashy-black clay, which either shows little change in the 3-foot section or passes in the subsoil, at depths of 18 to 30 inches, into a bluish-black, olive-colored, or dark bluish gray heavy clay, stiff and plastic when wet and almost impervious to moisture. In some areas there is a relatively large admixture of sand in the soil and subsoil, but rarely enough to make the type a clay loam. The surface soil when moist is very sticky and plastic. The Wilson clay does not effervesce with hydrochloric acid as do the majority of the prairie soils with which it is associated on the Black and Fort Worth Prairies. The chief areas lie near Keller and Village Creek School, in the vicinity of the boundary between the Grand Prairie and the East Cross Timbers.

The topography is prevailingly flat to nearly level, and drainage is poor during wet seasons. If cultivated when moisture conditions are favorable, the soil crumbles readily into a desirable tilth.

In its virgin condition the Wilson clay supports some scattering mesquite trees, with a good growth of mesquite grass and bluestem, which afford excellent grazing.

Cotton and corn are the chief crops grown on the type. Some wheat and oats are grown. Cotton yields from one-fourth to one-half bale per acre in normal seasons, and corn from 25 to 40 bushels. Wheat and oats yield from 10 to 20 and 35 to 50 bushels per acre, respectively, but these grains are inclined to lodge in wet seasons. The grain sorghums do well. In one field noted, sorghum produce 12 tons of silage per acre. Broomcorn probably would do well. The selling price of land of this type ranges from $125 to $175 an acre.

The soil of this type is either neutral or acid, and the addition of lime would be beneficial. Better drainage also would prove of advantage. The type is inclined to droughtiness in extended dry seasons, and the maintenance of a soil mulch for the preservation of moisture is beneficial.

DURANT FINE SANDY LOAM.

The Durant fine sandy loam consists of reddish-brown to brown fine sandy loam, underlain at 6 to 10 inches by brownish-red to red clay, usually of stiff structure, with mottlings of yellow and yellowish brown below 10 to 18 inches, the proportion of yellow in many areas increasing with depth. In places the lower subsoil is

mottled reddish brown and brownish yellow. Fragments of ferruginous sandstone and some black oxide of iron concretions are present on the surface and in the soil and subsoil. In places this ferruginous material is sufficiently abundant in the lower subsoil to form a hardpan almost impenetrable to moisture. Such material, however, is rarely plentiful enough in the soil to interfere with cultivation, and its presence in moderate amounts is said to be an aid to the conservation of moisture.

This type occurs mainly in the vicinity of Crowley and Wheatland, with several small areas near Keller. Its total extent in the county is small. Most of it is developed on flat to nearly level interstream areas and on account of this topography and the heavy subsoil the drainage is poor in wet seasons.

This type is inclined to droughtiness during long periods of dry weather, but it is not so droughty as the clay loam of the series. Frequent shallow cultivation, which minimizes the loss of moisture by evaporation, is necessary during dry seasons for good results. The soil appears to be only fairly well supplied with organic matter. The typical Durant fine sandy loam is noncalcareous in soil and subsoil, but a few small areas approaching in character the Crawford soils are calcareous in the lower subsoil.

The greater part of the Durant fine sandy loam is under cultivation. Cotton yields one-fourth to one-half bale per acre; corn, from 15 to 25 bushels; wheat, from 10 to 15 bushels; oats, from 15 to 30 bushels; and peanuts, from 35 to 60 bushels. The type is well adapted to peanuts and watermelons, and muskmelons do well. Sweet potatoes and cowpeas are crops that should succeed on this soil. The latter, which tends to enrich the soil with nitrogen and organic matter, might well be grown more extensively. The type is valued at $100 to $150 an acre.

DURANT CLAY LOAM.

The surface soil of the typical Durant clay loam consists of a dull-red to brownish-red or reddish-brown clay loam or sandy clay loam 5 to 8 inches deep. This passes into a dull-red or brownish-red, stiff, heavy clay, which ordinarily extends throughout the 3-foot section without much change, except that faint yellow mottling appears locally below 24 inches. In some areas the lower subsoil is streaked with yellowish brown and reddish brown or is mottled with these two colors. Fragments of ferruginous sandstone and claystone are commonly found scattered over the surface and mixed with the soil and subsoil. In some places they are so abundant as to make boring impossible and in other places they form an almost impenetrable hardpan in the subsoil. They do not, however, prevent cultivation, and when present add somewhat to the friability of the soil. Black oxide of iron concretions occur locally. This ferruginous material is very abundant on some of the ridge crests. In places small rounded quartz gravel is present. Neither soil nor subsoil effervesces with hydrochloric acid.

A few areas have an ashy-colored clay loam surface soil with a light-red upper subsoil which passes into yellowish-brown, plastic, sticky clay. The immediate surface of some included areas is a

loam rather than a clay loam and in others 2 or 3 inches of fine sandy loam is present at the surface. Upon cultivation the soil of these areas assumes a sandy clay loam texture.

The Durant clay loam is mainly a prairie soil, only a few marginal areas having a growth of post oak and blackjack oak. The type is mapped chiefly along the western edge of the East Cross Timbers. The areas lie at a higher altitude than the prairie type to the west, and appear to be prairie outliers of the Cross Timbers belt. The more important areas of the type are those in the vicinity of Village Creek School, near Crowley, and between Keller and Birdville. Several of the areas near Keller have the loam surface soil mentioned above.

The Durant clay loam is noncalcareous, except in some included areas representing an approach to the Crawford soils, in which the subsoil below 24 to 30 inches is a mottled or streaked red and yellow, stiff, calcareous clay, and in a few others where the lower subsoil is a greenish-yellow, heavy, stiff, calcareous clay.

The type occupies the crests of ridges and hills and the slopes along streams, and is well drained. On account of the heavy character of the subsoil the type does not store large amounts of moisture, and in dry years it is inclined to be droughty. It should be mulched for conservation of moisture.

Cotton, the chief crop, yields from one-fourth to one-half bale per acre and corn from 20 to 30 bushels. Some wheat and oats also are grown, the former yielding 10 to 15 bushels and the latter 15 to 30 bushels per acre.

The type is valued at $100 to $150 or more an acre, depending on location and improvements.

HOUSTON BLACK CLAY.

The Houston black clay consists of a black calcareous clay, passing into black or very dark brown, stiff, plastic clay, and this, locally, into dark yellowish brown calcareous clay. The lower part of the subsoil in places ranges from a brown to an olive color. When wet the soil is stiff and "waxy," but on drying it crumbles readily. Chert fragments, generally small, occur locally in the soil material and in a few places on the surface. Lime concretions are more or less common in the subsoil and are found here and there in the surface soil. When cultivated the soil assumes an ashy-gray color on drying. Small areas of the Houston clay are included with the black clay.

This type occurs in the Black Prairie region east of Arlington and Mansfield and on the Grapevine Prairie. In Tarrant County it is derived from the Eagleford shales and is locally called "black waxy" land, on account of the waxy, tenacious character of the soil when wet. The type is important both because of its extent and agricultural value. The development in eastern Tarrant County represents the most western outlier of the Black Prairie belt, which includes extensive areas in the State east and south of Tarrant County.

The topography of the Houston black clay varies from nearly level to undulating and slightly rolling, but in regions of the latter topography the Houston clay is more extensive than the Houston black clay.

When moderately wet the soil of this type is so sticky that it is difficult to handle. When only slightly moist the soil crumbles and works readily into good tilth, the high lime content of the soil having this effect. In some places the soil does not effervesce with hydrochloric acid in the surface layer, but effervescence is nearly always obtained within 10 inches of the surface.

The topography of the type in general is favorable to surface drainage, although there are flat areas in which water sometimes stands on the surface after rains. In such locations white incrustations of alkali salts appear on the surface after the evaporation of the water. Analyses of the immediate surface material in such areas show an accumulation of salts of sufficient concentration to be harmful to ordinary crops. These features are not common enough to affect the value of the soil as a whole.

A noticeable condition affecting the production of cotton on this soil is the presence in places of the disease known as root rot. Though this is locally ascribed to alkali, it has been shown to be due to the root fungus *Ozonum*. Specialists in plant diseases recommend rotation as a partial remedy for this disease.

The Houston black clay is an important soil in Tarrant County, and more than 90 per cent of it has been improved and is under cultivation. Though farmed for a long time, it has apparently declined little if at all in productiveness, and no fertilizers are used on crops.

The type is used for the production of corn, cotton, wheat, oats, Johnson grass hay, grain sorghum, and broomcorn. The chief crops are cotton and corn. Cotton ordinarily yields from one-half to three-fourths bale per acre, with yields of 1 bale per acre not uncommon. The yield of corn varies with the season, but yields of 25 to 40 bushels are obtained in normal seasons. Oats yield from 30 to 60 bushels, and wheat from 12 to 20 bushels per acre. Grain sorghums yield from 6 to 10 tons of silage and from 3 to 5 tons of dry forage, generally in two cuttings. The yield of broomcorn is good, two crops being obtained in seasons of sufficient moisture. Some alfalfa is grown, and good yields are obtained in seasons of well-distributed rainfall. In dry seasons the crop suffers for want of moisture and also from the cracking of the soil which injures the roots.

Suggestions for handling this type include the use of a crop rotation for the control of cotton root rot; the drainage of flat areas by ditching or tiling; the planting of oats or other alkali-resistant crops and incorporation of coarse organic litter in the small alkali areas; and the protection of areas inclined to erosion by grass or other cover crops or by terracing.

Land of this type sells for $175 to $300 or more an acre, depending on improvements, nearness to markets, and area under cultivation.

HOUSTON CLAY.

The Houston clay, to a depth of 6 to 12 inches, consists of a dark-brown to brown, stiff clay, usually calcareous. This passes into a brown to light-brown, heavy calcareous clay, which in turn generally grades into a yellowish-brown calcareous clay at a depth of about 30 inches. This lower layer does not appear everywhere within the 3-

foot section, but on eroded slopes it may be reached at 18 inches. Chert fragments are present here and there on the surface, and lime concretions are found locally on the surface and through the soil section.

This type occurs in the Black Prairie in small areas from Arlington and Mansfield eastward, and on the Grapevine Prairie. The largest area lies southwest of Grapevine.

The Houston clay is derived from the Eagleford shales. The type occupies rolling country and the slopes descending from the Houston black clay to the stream bottoms. Erosion has been especially active in some areas, leaving gullies of considerable length and depth. The drainage of the type is good.

The type is adapted to the same general crops as the Houston black clay and produces about the same yields. Some cotton root rot was noted. The general suggestions made for handling the Houston black clay apply to this clay type. This land sells for $175 to $250 an acre.

KIRVIN FINE SANDY LOAM.

The Kirvin fine sandy loam is a light reddish brown to brown fine sand to fine sandy loam, passing into reddish-brown fine sand to fine sandy loam, and underlain at depths of 5 to 15 inches by red clay, which usually shows mottlings of yellow at depths of 18 to 20 inches, the yellow usually increasing with depth. In some places in the lower subsoil the yellow ranges to yellowish gray. Although there is enough fine sand or red to yellow crumbly iron oxide material in the subsoil in places to impart a degree of friability, the typical subsoil is moderately stiff to stiff. Here and there, especially on ridges and steep slopes, the subsoil is brick red to depths of 3 feet or more. Some of the hilltops and ridge crests are decidedly gravelly, small patches having so much ferruginous rock, consisting mainly of platy sandstone fragments and concretions, as to interfere somewhat with cultivation. Some of the lower slopes and flat areas are very gravelly. As a rule, however, this type does not contain enough gravel to be classed as a gravelly fine sandy loam. On some of the hills and ridges the ferruginous rock is present through the 3-foot section, and occasional large fragments are present on the surface. Neither soil nor subsoil effervesce with hydrochloric acid.

The Kirvin fine sandy loam is the dominating type of the East Cross Timbers region in Tarrant County, occupying one-half or more of its total area in the county. It is derived from the rocks of the Woodbine formation.

The type occurs on ridges and hills with gentle to moderate slopes. The prevailing topography is undulating to rolling and slightly hilly. The drainage is good to excessive in the more rolling areas, where the run-off in places is sufficient to cause destructive erosion.

The greater part of this type is under cultivation. The unimproved part supports a growth consisting chiefly of post oak and blackjack oak, with some sumac and elm in places. Bermuda grass and broom sedge supply some pasturage.

Corn and cotton are the chief crops. Oats and wheat are grown on small acreages. Sweet potatoes and peanuts do well on the type,

and fairly extensive acreages are devoted to these crops. Watermelons and muskmelons also are successful crops on this soil. Peaches and small fruits occupy a considerable area. The sorghums are grown for hay. Cotton yields from one-fourth to one-half bale per acre or slightly more when the boll weevil is not active, or when the crop is planted sufficiently early to prevent serious damage. Corn yields from 15 to 25 bushels, oats from 20 to 45 bushels, and wheat from 8 to 12 bushels per acre. Sweet potatoes produce from 50 to 125 bushels, and peanuts from 20 to 60 bushels per acre. The yield of sorghum hay ranges from 2 to 5 tons per acre. Both wheat and oats are pastured to some extent during the winter.

All areas of the Kirvin fine sandy loam would be benefited by applying barnyard manure or incorporating organic matter in some other form, as by plowing under green crops, such as oats or cowpeas. The growing of cowpeas or peanuts in rotation or in combination with cotton or corn would work to the same end. Efforts also should be made to check erosion, which is causing damage in the more rolling areas; terraces should be constructed to prevent washing where simpler means are not sufficient. In areas where the subsoil can be reached in plowing, the turning up of thin layers of this heavier material and mixing it with the surface soil would improve the land. Maintaining a surface mulch in cultivated fields is necessary for the proper conservation of moisture during the summer months.

Kirvin fine sandy loam, flat phase.—The flat phase of the Kirvin fine sandy loam includes level to nearly level areas in which the drainage is not quite so good as in the areas of the typical soil. The surface soil in such imperfectly drained areas varies from a light-brown or grayish-brown to brown fine sand to fine sandy loam, 8 to 15 inches deep. The subsoil is a dull-red, reddish-yellow, or mottled red and yellow, moderately stiff or semifriable clay loam to sandy clay, which grades into stiff clay loam of reddish-yellow or yellow color. In some of the more poorly drained areas the lower part of the subsoil consists of a mottled red, yellow, and gray, or yellow and gray, rather stiff clay. Ferruginous fragments are present on the surface and in the soil and subsoil, but they are not so numerous as in typical areas. In some places there is between the soil and subsoil a gradational layer of yellowish-red or yellowish friable fine sandy loam to fine sandy clay. This, where present, is generally from 4 to 10 inches thick. Neither the soil nor subsoil effervesces with hydrochloric acid. The phase is slightly less in need of humus than the typical soil, but would nevertheless be benefited by the addition of organic matter.

The same general crops are grown as on the Kirvin fine sandy loam, and approximately the same yields are obtained.

Kirvin fine sandy loam, stony phase.—The Kirvin fine sandy loam, stony phase, includes areas in which there is so much fragmentary ferruginous material on the surface or in the soil mass that profitable cultivation is impracticable. This land has very little agricultural value except for grazing. Most of it is forested with post oak and blackjack oak or covered with Bermuda grass.

The phase occurs chiefly as low hillocks throughout the entire region covered by the East Cross Timbers. Several areas southwest of Keller and south of Crowley stand out as isolated bodies in the Grand Prairie.

Kirvin fine sandy loam, deep phase.—The soil of the deep phase of the Kirvin fine sandy loam consists of 15 to 24 inches of grayish-brown to yellowish-brown slightly loamy fine sand, which passes into a subsoil of yellow or yellowish-brown fine sandy loam to fine sandy clay, mottled in the lower part with red. In some areas the subsoil closely approaches the texture of a clay of stiff structure, resembling the Tabor subsoil except in being redder. In other places the subsoil is highly mottled with red and yellow, the typical Kirvin subsoil. Neither soil nor subsoil is calcareous. Fragments of ferruginous rock are generally present on the surface. This phase is not extensive, its chief development being in the neighborhood of Bransford and Dove. From an agricultural standpoint also it is relatively unimportant.

The topography of areas of the phase is nearly level to gently undulating. The drainage is good, owing to the structure of soil and subsoil. The phase is normally retentive of moisture, especially when the surface is kept well mulched. The greater depth of the soil in this phase enables it to store more water than the typical soil, and the phase is moist when the typical soil is dry.

Cotton, corn, sweet potatoes, and peanuts are the leading crops. Yields of cotton and corn are below the average of the typical Kirvin fine sandy loam; those of sweet potatoes and peanuts are about the same. Blackberries and dewberries are grown on the type and are found to do well, yields as high as 100 crates per acre having been reported. Virgin land is covered with the forest growth typical of the region.

This soil is deficient in organic matter. This can be supplied by the methods suggested for the typical Kirvin fine sandy loam.

Kirvin fine sandy loam, eroded phase.—The eroded phase of the Kirvin fine sandy loam really represents areas of Kirvin clay formed by removal of the surface fine sandy loam soil by erosion and exposure of the clay subsoil. A thin layer of the sandy soil remains in some places, but the soil when plowed is essentially a red to dull-red, rather stiff sandy clay loam to clay, and the subsoil the same except for mottling with yellow below depths of about 18 inches. Layers of ferruginous rock occur locally within the 3-foot section, and numerous platy fragments, some of considerable size, are scattered over the surface.

The phase occupies the more or less steep slopes leading from the uplands of the East Cross Timbers to the stream bottoms or terraces. Its total area is not large. Aside from its value for grazing, the phase has little agricultural importance. It is covered with post oak and blackjack oak.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the typical Kirvin fine sandy loam:

Mechanical analyses of Kirvin fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
445641..	Soil, 0 to 7 inches.....	0.2	0.7	0.7	48.7	29.3	13.5	6.8
445642..	Subsoil, 7 to 36 inches.	.2	.2	.5	48.9	13.3	9.1	27.7

NORFOLK FINE SAND.

The Norfolk fine sand consists of a grayish-brown fine sand passing at about 6 to 8 inches into a subsoil of yellowish-brown fine sand which extends to a depth of 3 feet or more. Some included patches have an orange-yellow fine sand below depths of about 24 inches.

The type is confined to the East Cross Timbers, and its total area is not large. The largest bodies lie near the northern border of the county.

The greater part of this type supports a stand of blackjack oak and post oak with undergrowth of smaller plants. The type is not very productive in spite of the fact that the soil retains moisture fairly well. Corn produces from 10 to 15 bushels, and cotton from one-fifth to one-fourth bale per acre. Sweet potatoes do well, as do peanuts and most truck crops, especially after the incorporation of organic matter, which can be readily added by growing cowpeas or by applying stable manure. Cowpeas with crab grass, which volunteers in cultivated fields, give a very palatable hay. The value of land of this type ranges from $15 to $50 an acre.

TABOR FINE SANDY LOAM.

The surface soil of the typical Tabor fine sandy loam consists of a light-brown to brown or grayish-brown fine sand to fine sandy loam 6 to 18 inches deep. This is underlain by a subsoil of yellowish-brown to yellow or pale-yellow, stiff heavy clay loam to clay, in places compact in the lower part of the profile and locally showing some gray or red mottling. The soil generally grades into the subsoil through a layer, 4 to 6 inches thick, of yellow to pale-yellow fine sandy loam to fine sandy clay loam. No effervescence occurred with hydrochloric acid either in the soil or subsoil.

In a few included areas the material in the upper part of the profile is slightly mottled with red. These areas represent an approach toward the Kirvin fine sandy loam, with which the type is closely associated. Small areas of Lufkin fine sandy loam are also included.

This type occurs in the East Cross Timbers, having its greatest development in the vicinity of Waltons Chapel and in a section extending north from Hurst to the county line. It occupies low slopes and flats adjacent to drainage ways. It is not as well drained as the Kirvin soils, nor as poorly drained as the Lufkin.

The Tabor fine sandy loam is one of the more extensive soils of Tarrant County, covering 37,056 acres, or 6.5 per cent of the area of the county. Probably one-half of it is under cultivation. It was originally forested, chiefly with post oak and blackjack oak. Uncultivated areas are used for pastures, in which Bermuda grass and broom sedge supply much of the forage.

Cotton, corn, oats, the sorghums, sweet potatoes, and peanuts are the important crops. Cotton yields from one-fifth to one-half bale per acre; corn, 15 to 25 bushels; and oats, about 25 bushels per acre. The sorghums are cut chiefly for hay, and yield from 2 to 4 tons per acre. Peanuts yield from 30 to 60 bushels per acre, and sweet potatoes from 60 to 100 bushels or more.

Farms made up of this type of soil command prices ranging from $60 to $125 an acre, depending largely on location and improvements.

The chief need of the Tabor fine sandy loam is organic matter, which can be effectively added by growing leguminous crops, such as peanuts and cowpeas, or by incorporating barnyard manure. Though the soil is fairly retentive of moisture, the supply should be husbanded by maintaining a mulch in fields devoted to intertilled crops.

LUFKIN FINE SANDY LOAM.

The Lufkin fine sandy loam consists of a layer of brownish-gray to gray fine sandy loam to fine sand, usually passing into a layer of gray or yellowish-gray loamy fine sand or fine sandy loam, and underlain at 8 to 18 inches by a subsoil of dark-gray, gray, yellowish-gray, or bluish-gray, stiff, heavy clay, which may be more or less mottled with yellowish brown, yellow, and gray at lower depths. The subsoil when wet is very plastic and almost impervious to moisture. Typically neither soil nor subsoil is calcareous. In some included areas the subsoil passes at about 24 inches into yellowish or olive-colored heavy clay, which is calcareous and contains some lime concretions. In places, as 2 miles north of Mansfield, the soil closely approaches the Wilson soils, and in this particular area some Wilson clay loam is included with the type. In small included areas in the vicinity of Handley the upper subsoil is a mottled red and yellow clay, such areas grading in character of subsoil toward the Kirvin or Durant series.

The Lufkin fine sandy loam occurs in the East Cross Timbers region. The areas are generally small and the total extent of the type not large. The chief development is in the vicinity of Smithfield and Bedford. This type is closely associated with the Tabor series, and small areas of each of these soils have been included in the other.

The surface is flat to nearly level, the type occupying naturally poorly drained flats and depressions and areas along small drainage ways. The underdrainage is restricted by the heavy subsoil, and in the flats and depressions the surface water is removed chiefly by evaporation. Such areas generally show alkali incrustation after the water has disappeared.

Only a small proportion of the Lufkin fine sandy loam is under cultivation, but the areas farmed give fairly good yields of cotton and corn. Wheat and oats are grown on small acreages. Cotton yields about one-fourth bale per acre; corn, 10 to 20 bushels; wheat, 8 to 15 bushels; and oats, about 20 bushels. Peanuts do well in the better drained areas. In the virgin condition the type supports a forest consisting mainly of blackjack oak and post oak. A stand of Bermuda grass and broom sedge makes such areas suitable for pastures. The type is valued at $60 to $125 an acre.

NIMROD FINE SAND.

The Nimrod fine sand consists of 5 to 8 inches of a grayish-brown fine sand of loose structure, underlain by a subsoil of light-gray to pale-yellow loose fine sand, which extends to depths of 3 feet or more. In some small areas a fine sandy clay, mottled gray and yellow and occasionally red, is encountered at 30 inches or below.

This type occurs in the West Cross Timbers section in the northwestern part of the county. It occupies slopes and flats, and is generally well drained, though a few of the slopes are somewhat seepy.

In its virgin condition the type is forested mainly with blackjack and post oak and some sumac. Very little of the type is under cultivation, and the yields of crops are low. Cotton yields one-sixth to one-third bale per acre. The type is best suited to peanuts, cowpeas, sweet potatoes, muskmelons, and watermelons, some of which are grown. The type is acid to litmus paper, and liming should prove beneficial in growing such crops as peanuts. Owing to lack of organic matter and the incoherent structure, the soil drifts badly. Incorporating barnyard manure or plowing under green crops will correct this condition. The growing of legumes, such as peanuts and cowpeas, would improve the soil. With the maintenance of a surface mulch, the type holds moisture well, especially where the clay subsoil appears at depths approximating 3 feet.

WINDTHORST FINE SANDY LOAM.

The Windthorst fine sandy loam consists of light-brown, grayish-brown, or reddish-brown loamy fine sand to fine sandy loam, passing at about 6 to 10 inches into dull-red fine sandy clay to clay loam, which becomes mottled with yellow in the lower subsoil, where the clay is usually plastic and rather tough. In some areas the lower subsoil consists of yellowish clay mottled with red. Included with the type, as mapped, are areas in which the subsoil is a red friable fine sandy clay, more friable than is typical of the series. Such inclusions, if of sufficient extent, would be mapped as Stephenville fine sandy loam—a type found in Erath County.

Fragments of the reddish-brown sandstone of the Walnut and Paluxy sand formations, from which the type is derived, are scattered over the surface on some of the slopes, and occur in places in the soil section. These rocks are not numerous, however.

The type is confined to the northwestern corner of the county, in the vicinity of Azle, where it is prominently developed.

The topography varies from nearly level to rolling, and the drainage is good to excessive. The type is dissected by the streams entering the Trinity River.

A considerable part of the type gives an acid reaction to litmus paper, and none of the tests with hydrochloric acid indicated the presence of lime carbonate in the soil. The greater part of the type is in forest, the chief growth being blackjack oak and post oak, with some sumac.

Corn, cotton, peanuts, and sweet potatoes are the leading crops. Corn yields from 10 to 20 bushels, cotton from one-fourth to three-eighths bale, peanuts from 30 to 60 bushels, and sweet potatoes from 50 to 100 bushels per acre. Some watermelons and muskmelons also are grown.

Land of this type sells for $40 to $100 an acre, according to location and improvements.

The growing of peanuts and cowpeas would improve the land through the addition of nitrogen and organic matter. The production of sweet potatoes could be increased to advantage, the type being much better for this crop than for corn or cotton. The addition of lime to neutralize the acid condition of the soil would improve it for some crops. In places where the organic content is unusually low stable manure should be applied. Muskmelons and watermelons

can be grown to advantage, with Fort Worth as a market, and their production might well be extended on this type.

The following table gives the results of mechanical analyses of samples of the soil and subsoil of the Windthorst fine sandy loam:

Mechanical analyses of Windthorst fine sandy loam.

Number.	Description.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
445664..	Soil, 0 to 8 inches.....	0.0	0.3	0.5	62.6	19.4	10.3	6.8
445665..	Subsoil, 8 to 36 inches.	.9	1.6	2.7	34.5	22.2	26.8	11.4

ELLIS CLAY.

The Ellis clay consists of a greenish-brown to brown clay, underlain at about 4 to 12 inches by olive-colored heavy clay. The type is derived from shale, exposures of which appear in cuts in the lower subsoil and substratum. The rock is generally of blue or olive-green color. The soil is very plastic when wet.

Only one small area of the type is mapped in Tarrant County. This lies in the extreme southeast corner, adjacent to both the Ellis and Dallas County lines. The topography is rolling to hilly, making most of the land unsuited to cultivation. Some small mesquite trees grow on the type. The Ellis clay is best suited for pasture.

BELL CLAY.

The Bell clay, to a depth of 8 to 36 inches or more, consists of a black calcareous clay, which in places carries lime concretions on the surface and through the soil and subsoil. Where the black soil is not 3 feet deep, it is underlain by a blue-black, slate-colored, or ashy-gray, stiff, heavy, calcareous clay, and in a few areas it consists below 30 inches of an olive-colored, stiff, calcareous clay.

The Bell clay occurs on the second bottoms of the West Fork of Trinity River and on the high terraces in the northeastern and southeastern parts of the county. Its greatest development is in the vicinity of Britton.[6] On the high terraces it was almost impossible to draw a definite line between this type and the Houston black clay, the criterion used being the presence or absence of waterworn gravel.

The topography varies from nearly level to somewhat rolling. Where the latter condition prevails the soil grades toward the Lewisville clay. The drainage is good.

Though this soil is fairly retentive of moisture, crops suffer during extended dry spells. When wet the type is waxy, sticky, and plastic, and roads become boggy. If cultivated when slightly moist, the type turns easily and breaks into a good tilth. On drying the surface assumes generally an ashy-black color and crumbles like other limy clays. Clods formed by wet plowing tend to crumble when rained on. Heavy draft power is required for efficient cultivation of the type.

[6] The mapping along the Ellis and Tarrant County line does not correspond, studies subsequent to the issuance of the Ellis County report indicating that the material at Britton is high terrace rather than upland. Changes in nomenclature also have been made since Ellis County was surveyed.

This is a strong, productive soil, and good yields are obtained in seasons of well-distributed rainfall. Cotton and corn are the chief crops grown, with some oats and wheat. Cotton yields, when the boll weevil is not very active, from one-fourth to three-fourths bale per acre, corn from 25 to 60 bushels, oats from 25 to 50 bushels, and wheat from 12 to 20 bushels. The sorghums are grown for silage and forage, yielding from 8 to 10 tons of silage or 3 to 6 tons of fodder per acre. Some broomcorn is grown on the type, the product going to the broom factory at Dalworth. The price of land of this type ranges from $150 to $250 or more an acre.

This soil is the terrace equivalent of the Trinity clay of the first bottoms. On the high terrace it lies from 100 to 200 feet above the level of the bottoms.

LEWISVILLE CLAY.

The Lewisville clay consists of a dark-brown to brown, fairly stiff clay, which grades at depths ranging from 6 to 10 inches into brown or dark-brown stiff clay, usually containing some cream-colored or whitish limy material. At 24 to 30 inches this in turn passes into yellowish or cream-colored and whitish clay or chalky material. On the slopes where erosion is active the chalky material comes nearer the surface and in places is exposed. Some small chert fragments and ironstone are present on the surface of some areas, and rounded quartz and quartzite gravel is found here and there. Both soil and subsoil are generally calcareous.

A noticeable feature of the type is the presence at depths of 3 to 10 feet or more of a layer of conglomerate, locally called "concrete," composed of rounded limestone and chert gravel cemented by calcium carbonate. (Pl. IX, fig. 2.) This may be the source of the chalky material in the subsoil. When this "concrete" decomposes it changes to a salmon or cream-colored chalky substance containing some partly decomposed chert. These layers are well developed in the Trinity River terraces, where they are rarely decomposed to the same extent as on the high terraces.

In some areas a yellowish-brown or buff cast is noticeable in the lower part of the subsoil, and white lime concretions are common throughout the subsoil, which is nearly always calcareous. In an area east of Birdville the soil consists of brown, highly calcareous clay passing at 8 to 10 inches into yellowish-brown, moderately sticky, calcareous clay, having a faint reddish or buff color. Here in many places there is an abundance of lime concretions in the lower subsoil. At depths ranging from 30 inches to 10 feet these areas are underlain by a substratum of rounded limestone and chert gravel more or less solidly cemented by calcium carbonate, forming the "concrete" appearing in the more typical areas of this soil. On the Trinity River terraces this layer has a thickness ranging from a few to 10 feet or more, and in such places it is mined for road material. Along the smaller streams this bed is not generally over 6 to 12 inches thick. It is exposed here and there on slopes. This "concrete" or "mortar beds" material is encountered locally at depths of 30 to 36 inches.

The Lewisville clay occurs on the high terraces in the southeastern, eastern, and northeastern parts of the county, where it has been

accumulated as alluvial or alluvo-colluvial deposits. In places it occupies terrace remnants overlying the residual material of the Black Prairie. The type here bears the same relationship to the Bell clay as does the Houston clay to the Houston black clay on the uplands. Areas of the type also occur in the western part of the county, a notable area lying south of Lake Worth. The type is an important agricultural soil of considerable extent.

This type occupies undulating areas and the slopes from the more nearly level Bell clay to the stream bottoms. Owing to the greater erosion in the areas of this type, the soil has not accumulated as much organic matter as the Bell clay. The drainage is good and the soil is fairly retentive of moisture, though in considerable periods of dry weather it cracks badly and becomes droughty. Both soil and subsoil are very sticky and plastic when wet.

Most of the Lewisville clay is under cultivation. In the virgin state it supports a growth of small mesquite trees and grasses and is used for pasture. Cotton and corn are the chief crops; wheat and oats are grown to some extent, and the sorghums are grown for silage. Cotton yields one-fourth to one-half bale per acre or slightly more, and corn from 25 to 35 bushels. Wheat generally yields 15 to 18 bushels, but yields of 30 bushels have been reported. The ordinary yield of oats is from 30 to 45 bushels, 70 bushels being reported in exceptionally favorable years. When grain sorghums are cut for silage they yield from 8 to 10 tons, and for dry forage from 3 to 5 tons per acre. Both Johnson grass and Colorado ("hurrah") grass are pests on the type, and frequently are cut for hay. Two cuttings a year are made, each yielding about three-fourths to a ton per acre.

The type is valued at $150 to $250 an acre, the price depending upon such factors as improvements or location with respect to markets.

If this soil is plowed and cultivated when in good condition, as regards moisture content, it crumbles readily and forms a good tilth. If plowed when too wet, the soil clods, but the clods break up readily after a rain. Terraces are needed in places to protect the slopes from washing.

Lewisville clay, eroded phase.—The eroded phase of the Lewisville clay includes slopes from which the alluvial material has been partly washed off, so that the underlying residual material is exposed in places.

The layer of conglomerate described in connection with the typical Lewisville clay is exposed locally on the slopes. Fragments of chert are present here and there on the surface. Some of the residual material has an olive color, like that in the lower depths of the residual Black Prairie material, especially in the Ellis clay areas, and small patches of Ellis clay have been included with this phase.

The total area of the eroded phase of the Lewisville clay in Tarrant County is not large. It occurs in several areas near the Dallas County line, the largest of which lies south of the Trinity River. This land is used only for pasture. It supports a scattering growth of mesquite grass and bluestem.

Lewisville clay, reddish-brown phase.—The soil of the Lewisville clay, reddish-brown phase, consists of reddish-brown to brownish-red or dull-red clay loam, usually fairly friable in structure, but

sticky when wet and somewhat plastic; this grades at 6 to 10 inches into red, stiff clay, slightly plastic to moderately friable in structure, which extends to a depth of 3 feet or more without change, except in a few areas in which the material below 30 inches is yellowish red. Gravel composed of limestone, chert, and quartzite appears here and there on the surface.

Several areas in the vicinity of Barron Field consist of a brownish-red or reddish-brown sandy clay or of 2 or 3 inches of fine sandy loam passing into clay loam, which grades into brownish-red or light-red clay, and this in turn at 20 to 24 inches into lighter colored clay containing some lime gravel.

Both soil and subsoil locally contain lime concretions, and both are prevailingly calcareous. The conglomerate or "concrete," described in connection with the Lewisville clay, at depths ranging from about 3 feet to 10 feet; and the "mortar beds" material into which this conglomerate decomposes is common, appearing in some places within the 3-foot section.

The reddish-brown phase of the Lewisville clay occurs in isolated areas on the terraces of Big Fossil Creek, and Village Creek. The topography is undulating to gently rolling. In places the soil occupies fairly steep slopes leading from the terraces to the stream bottoms. The drainage is good to excessive.

Cotton yields one-fourth to two-fifths bale per acre on this land; corn, 20 to 35 bushels; and oats, 25 to 40 bushels. Wheat is rarely grown. Some milo and kafir were seen, both apparently thriving.

IRVING CLAY.

The Irving clay consists of a dark ashy gray to black, stiff, silty clay, which may extend to depths of 36 inches or more without change, but generally becomes ashy gray or very dark gray below 15 to 24 inches, and, in the flatter areas, may contain mottlings of rusty brown and gray in the lower subsoil. Black oxide of iron concretions are found here and there.

This type differs from the Bell clay in that it occupies somewhat more nearly level and less well drained areas on the terraces and high terraces. Its chief difference, however, lies in the fact that hydrochloric-acid tests show no free lime carbonate in either soil or subsoil.

The soil when wet is very plastic and sticky; and in order to avoid the formation of intractable clods, it must be plowed when at the right moisture condition. Clods formed in plowing do not crumble as readily when rained on as do those formed in the limy soils. This soil is not very retentive of moisture during dry seasons, and a mulch should be maintained in the fields by frequent cultivation.

The chief areas of this type occur on the high terraces in the vicinity of Webb and Mansfield. The total extent is not large. The principal crops are cotton, corn, wheat, and oats. Yields are slightly below those obtained on the Bell clay. The latter is preferred by the farmers and commands a slightly higher price.

SIMMONS CLAY.

The Simmons clay consists of 36 inches or more of a very dark brown to black clay or silty clay, or, in most areas of 12 inches of

such material grading into dark-brown, dark-gray, or dark brownish gray, heavy, stiff clay, which in turn passes at 24 to 30 inches into brownish-gray, gray, or olive-colored, heavy, rather tough clay. Lime concretions are generally present in the subsoil and locally in the surface soil, being abundant in places. Small rounded chert and quartzite gravel fragments are present here and there on the surface. Both soil and subsoil are generally calcareous.

The Simmons clay occurs on the terraces of the West Fork of Trinity River and of the larger tributaries of that stream. The elevation is well above overflow, some of the inner terraces being 50 feet or more above the first bottoms. The total area in this county is not large, the type occurring as isolated areas, mostly of small size. The largest bodies lie about 2 miles north of Riverside. The surface is level or nearly level, and the drainage is imperfect, surface drainage being restricted by the lack of fall and subdrainage by the heavy subsoil. Ditching is necessary in places.

In the more poorly drained areas alkali spots are noticeable after the evaporation of standing water. When wet the soil is very sticky and plastic, and cultivation is confined to periods when the soil contains the proper moisture content. Intractable clods form if the land is plowed when too wet, though the soil crumbles readily if plowed at the right time. On drying the soil has an ashy color.

The greater part of the type is under cultivation to cotton and corn, both of which do well. The small grains grow rank and lodge. Cotton yields from one-fourth to one-half bale per acre, or slightly more when not severely attacked by the boll weevil. Corn ordinarily yields from 30 to 50 bushels per acre.

Farm land of this type commands prices ranging from $100 to $200 an acre.

The Simmons clay is a strong, productive soil. Lack of drainage is its chief deficiency. This may be removed by ditching or tiling. Drainage and application of coarse organic manures or litter will correct alkali conditions that exist in parts of the type. Cotton root rot, when present, should be controlled by a change from cotton to some immune crop.

KALMIA FINE SAND.

The Kalmia fine sand consists of light-brown, grayish-brown, or brown fine sand, only slightly loamy, grading at about 2 to 6 or 8 inches into yellow or orange-yellow fine sand, which continues to depths of 3 feet or more. In some small areas a fine sandy loam or fine sandy clay, of yellow color, mottled with orange and red, is encountered within the 3-foot section, usually below 30 inches.

This type occurs on the terraces of the West Fork of Trinity River. The largest areas are those near Riverside and at the northern end of Lake Worth. The topography is nearly level, but the drainage is nevertheless good owing to the porous character of the material. Enough moisture is held to supply crops, especially where a mulch is maintained, in all except the driest seasons.

Very little of this type is under cultivation. It is used to some extent for the production of peanuts, watermelons, and muskmelons, and for trucking, but results are less satisfactory than on the fine sandy loam of the series. The soil drifts badly unless kept well

supplied with organic matter. Liberal manuring is essential to the production of good crops. Where forested, the chief tree growth consists of blackjack oak and post oak.

KALMIA FINE SANDY LOAM.

The Kalmia fine sandy loam consists of brown to light-brown or grayish-brown fine sand to loamy fine sand or light fine sandy loam, grading into yellow, pale-yellow, or orange-yellow fine sand to light fine sandy loam, underlain at depths ranging from about 12 to 20 inches by yellow fine sandy clay, which either extends to depths of 3 feet without change or is mottled with orange and red at depths below 24 inches. The subsoil is somewhat stiff in places, rather stiffer than the typical Kalmia fine sandy loam of the more easterly coastal plain streams.

This type occurs on the terraces of the West Fork of Trinity River, the important areas being those in the vicinity of Rock Hill Church and at Riverside. The surface is nearly level, but the drainage is good on account of the pervious character of the soil material. The subsoil structure also favors the capillary movement of moisture from below, and the type holds moisture well, especially if a mulch is maintained in the cultivated fields.

Cotton and corn are grown to a small extent, with yields of one-fifth to one-fourth bale of cotton and 10 to 20 bushels of corn per acre. Peanuts yield from 35 to 60 bushels per acre and three-fourths ton of hay. Cowpeas do very well, and when cut with crab grass form a palatable feed for horses. The chief industry is trucking or market gardening, the greater part of the type near Fort Worth being used for this purpose. The friable character of the surface soil makes intensive cultivation easy, and the good drainage causes the land to warm up early in spring. All the more important vegetables are produced. Small fruits, chiefly dewberries and blackberries, are grown to some extent. Muskmelons and watermelons do well. The Rocky Ford is the leading variety of muskmelon and the Tom Watson and Rattlesnake are among the most popular of the watermelons. Rather heavy manuring is necessary for good yields of vegetables, many growers applying from 8 to 12 tons of stable manure per acre. Virgin areas of the type support a growth of backjack oak and post oak.

The value of land of this type varies greatly with the location. Near Fort Worth the trucking and market-gardening lands are held at $300 to $400 an acre; farther from the city, where the type is used only for general farming, the price ranges from $75 to $125 an acre.

AMITE FINE SANDY LOAM.

The Amite fine sandy loam, to a depth of 8 to 15 or 20 inches, consists of brown to reddish-brown loamy fine sand to fine sandy loam; below this it is a red to dull-red, friable, heavy, fine sandy loam to fine sandy clay. In some areas the subsoil is a lighter red or yellowish red in the lower part of the 3-foot section, and in places is compact and slightly plastic below 30 inches. The soil is only fairly well supplied with organic matter. Neither soil nor subsoil is calcareous. A few small included areas have a very fine sandy loam texture.

This type is developed on the broad terraces along the bottoms of the West Fork of Trinity River, for a short distance up Clear Fork from the junction of the two streams, and along some of the larger creeks emptying into the West Fork. The terraces were formed by deposition of sediments derived in part from the West Cross Timbers region. Though originally deposited as first bottoms, the lowering of the stream channel has placed them in a terrace position. The type lies well above overflow, some areas being 50 to 75 feet or more above the bottom lands.

The Amite fine sandy loam is a very important type in Tarrant County, and the greater part of it is in cultivation. It supports a varied agriculture, the crops including cotton, corn, wheat, oats, peanuts, sweet potatoes, watermelons, muskmelons, berries, and garden vegetables. Dairying is followed in a small way. Dairying, berry culture, trucking, and market gardening are favored by the location of the type along the old Fort Worth-Dallas Highway, which gives a good direct route to the markets of both Dallas and Fort Worth. These industries are carried on mainly from Bedford eastward and near Euless and Tarrant. Milk routes from Fort Worth are operated as far east as Euless.

Cotton yields from one-fourth to one-third bale per acre, sometimes slightly more. Its production is favored by the fact that the soil warms up early in spring, permitting early planting, which is very desirable under boll-weevil conditions. Corn yields from 20 to 30 bushels per acre, wheat 8 to 15 bushels, and oats 20 to 40 bushels. Peanuts do especially well on this type, yielding from 40 to 60 bushels or more per acre. The yield of sweet potatoes in good seasons averages more than 100 bushels per acre. Watermelons and muskmelons do well, the former yielding as high as 200 to 250 melons, weighing from 25 to 30 pounds each, per acre, and the latter from 100 to 125 bushels in good seasons. The yield of dewberries and blackberries is largely dependent on the season, but in good years from 50 to 75 or more crates per acre is not an uncommon return, and yields of 100 crates per acre have been reported. Vegetables do well on the type.

Fertilization with barnyard manure is practiced in the growing of vegetables, berries, melons, and sweet potatoes, applications of 5 to 10 tons per acre being usual. The growing of cowpeas in rotation or in corn or other crops is recommended to supply nitrogen and organic matter. Peanuts should be grown more extensively to aid in upbuilding the soil. The use of sodium nitrate is said to hasten the growth of vegetables and berries designed for the early market.

Land of this type is held at $100 to $250 or more an acre, the latter price applying where trucking is followed.

Near the Dallas County line there are several small areas of a brownish-gray fine sandy loam or loamy fine sand overlying a subsoil of yellowish-red to reddish-yellow fine sandy loam, representing an inclusion of typical Cahaba fine sandy loam. These areas are not shown separately owing to their small extent. In the soil survey of Dallas County similar areas of larger size will be shown as the Cahaba fine sandy loam.

Amite fine sandy loam, deep phase.—The deep phase of the Amite fine sandy loam consists of brown to reddish-brown loamy fine sand

passing at depths of about 24 to 30 inches into reddish fine sandy loam, which continues to a depth of 3 feet or more. The topography varies from nearly level to slightly undulating. The drainage is good, yet the soil is fairly retentive of moisture.

This phase occurs in small areas on the terraces. It is derived from the same material as the Amite fine sandy loam, from which it differs chiefly in the greater depth to the subsoil and in its slightly inferior productiveness. A few small areas of this phase, being too small to separate satisfactorily, have been included with the typical Amite fine sandy loam.

Amite fine sandy loam, colluvial phase.—The material composing the colluvial phase of the Amite fine sandy loam is variable in both soil and subsoil. The phase includes narrow strips of soil along the base of the slopes from the higher terraces and uplands to the first bottoms. The areas lie slightly higher than the first bottoms, and are above overflow. Over much of this phase the profile consists of 8 to 10 inches of grayish-brown to reddish-brown fine sandy loam, overlying brown, reddish-brown, or red material varying in texture from fine sandy loam to clay loam or clay. Near the edge of the first bottoms recent-alluvial material is encountered locally within the 3-foot section. In places the lower subsoil consists of material similar to that giving the Kirvin soils.

The area of the colluvial phase of the Amity fine sandy loam is not large. The surface slopes gently toward the bottom, and the drainage is good. The greater part of this land is devoted to cotton and corn, with yields that are generally above the average for the county.

LEAF FINE SANDY LOAM.

The surface soil of the Leaf fine sandy loam is a grayish-brown to brown loamy fine sand to fine sandy loam, passing into light-brown or sometimes yellowish-brown fine sandy loam. The subsoil, beginning at depths of 8 to 12 inches, is a mottled red and yellow or red, yellow, and gray, plastic, stiff, heavy clay, the yellow color normally increasing with depth. Yellowish-brown or olive-colored, stiff, heavy clay occurs locally in the lower subsoil. In other places the lower subsoil consists of gray stiff clay mottled with red and yellowish brown, the proportion of red decreasing with depth. In places the upper subsoil is red, and mottling appears as a rule only in the lower part. Neither soil nor subsoil is calcareous. Some rounded chert and quartzite gravel is generally present on the surface. A few small included areas have the texture of a very fine sandy loam of low organic matter content. Some small included areas resemble the Kalmia soils, but are more plastic in the lower subsoil and more highly mottled with red.

The type occurs on the terraces of the West Fork of Trinity River and its tributaries, in positions varying from 15 to 50 feet or more above overflow. The sediments composing the type have been derived mainly from the West and East Cross Timbers regions, with probably some admixture from other soils to the north. The total area in Tarrant County is considerable. The largest bodies lie in the vicinity of Watson School, northeast of Arlington. The topography varies from nearly level to rolling; the rolling land

being near the first bottoms where the areas have been dissected by drainage from the uplands, and the more level land being nearer the uplands. The drainage varies from good on the more nearly level areas to excessive in the areas of rolling topography. The soil is not especially retentive of moisture.

In its virgin condition this type supported a forest growth consisting mainly of post oak and blackjack oak. It is estimated that less than half of the type is under cultivation, the rest being used for pasture. Cotton, corn, and peanuts are the leading crops. Sweet potatoes are one of the minor crops.

Cotton yields one-fourth to one-half bale per acre in normal seasons; corn yields 20 to 35 bushels, and peanuts yield 35 to 60 bushels per acre. The yields on this type could be increased by the addition of organic manures and the growing of cowpeas and peanuts to increase the nitrogen content.

LEAF CLAY LOAM.

The surface soil of the Leaf clay loam consists of 6 to 8 inches of light-brown to brown clay loam to sandy clay loam. In the better drained areas this passes into a subsoil consisting of red to dark-red stiff clay, mottled locally with yellow or gray or both. This in turn grades at about 20 inches into yellowish-brown, brown, or olive-brown, stiff, heavy clay, which is rarely calcareous. In the less well drained areas the subsoil consists of a yellowish-brown or olive-brown, heavy, stiff clay, which may be mottled in the upper part with gray or red. The type as mapped is more or less variable, the soil in places having a grayish color. In some small areas a layer of 2 or 3 inches of grayish-brown fine sandy loam overlies the typical subsoil. Cultivated fields present a spotted appearance.

The chief occurrence of the Leaf clay loam is in the vicinity of Wheatland and Everman, where it occupies several good-sized areas on the terraces of Village Creek. The materials in these terraces have come from the uplands of the East Cross Timbers and the Grand Prairie. The surface is mainly nearly level. The drainage varies from fair to good, being retarded in places by lack of slope and the heavy subsoil, and should be improved by ditching and tiling.

The greater part of the type is under cultivation, cotton and corn being the chief crops, with some wheat and oats. Cotton yields from one-fourth to one-half bale per acre, depending on seasonal conditions; corn yields 25 to 40 bushels; wheat, 10 to 18 bushels; and oats, from 20 to 40 bushels per acre.

The soil puddles if plowed when wet, and on drying bakes into intractable clods. The incorporation of organic manures would modify this tendency as well as increase the productiveness of the soil.

Land of this type is valued at $75 to $120 an acre, depending on state of improvement and location with respect to markets.

TRINITY CLAY.

The Trinity clay consists of a black calcareous clay which extends to depths of about 15 to 36 inches or more. Lime concretions occur

locally in the soil section and on the surface. Where the black material does not extend throughout the 3-foot section it grades usually into dark-gray or bluish-gray, heavy, calcareous clay, generally stiffer than the surface soil. Brownish mottlings appear in the lower subsoil in places. Both soil and subsoil are very sticky and plastic when wet, and the type becomes boggy after extended wet spells.

Where this soil lies adjacent to the sandy uplands or terraces or to areas of the Frio soils, it varies from the typical and includes small areas having a brownish clay or clay loam surface soil. The subsoil in these locations is fairly typical, but may have a slightly lighter texture and grayer color.

The Trinity clay is developed in the first bottoms of the West Fork of Trinity River and is subject to periodic overflow.

The Trinity soils are derived from material washed from the soils of the Black Prairie or Black Waxy belt, and the extreme western development of the type along the Trinity River in Texas is in Tarrant County. One area lies near Riverside, and a small isolated area 2 miles farther east. Its greatest development, however, is between a point 2 miles above Randols Mill and a point 2 miles west of the Dallas County line, where it occupies the entire first bottom for a distance of 14 miles, the width in places approaching 2½ miles.

The type in Tarrant County is composed chiefly of sediments washed from the Black Prairie, brought down into the bottom by the streams issuing from the Eagleford shales and also by the West Fork of Trinity River. The East Cross Timbers, or Woodbine sands formation, lies at the surface of the upland for a considerable distance downstream from the westernmost development of the Trinity clay, but the Trinity River Valley is deeply cut in this part of the county and the Eagleford shales exposed, which accounts for the development of this type so far upstream. There is of course some admixture of material derived from the Grand Prairie and other soil regions to the west.

The surface of the Trinity clay is almost level, there being generally only a slight, almost imperceptible slope toward the stream channel. Drainage ways from the upland dissect the type, and small sloughs and lakes occupy parts of old channels. The surface drainage, which is only fair, is assisted locally by ditches. The heavy character of the subsoil makes the subdrainage very poor.

Probably 40 per cent of the type is under cultivation. The farmers usually wait until after the "June rise" before planting their crops, mainly cotton and corn. Cotton yields one-half to 1 bale per acre in good seasons, though late planting renders it especially subject to attack by the boll weevil. Corn does well, yielding from 25 to 60 bushels per acre in seasons of well-distributed rainfall. The small grains lodge badly on the type and are rarely grown. Alfalfa does well, but is apt to suffer during overflows and during dry spells, as the soil cracks badly and injures the roots. Near Randols Mill some vegetables are successfully grown under irrigation. Uncultivated areas of the type are used for pasture. Pecan, oak, hackberry, elm, and cottonwood trees comprise the chief forest growth, and Bermuda grass is the principal forage.

The type includes small areas in which the surface shows white incrustations of alkali after evaporation of surface water. Such

areas are generally small and have very poor drainage. They can be improved by drainage and the incorporation of coarse litter.

If cultivated when it has the proper moisture content, the soil turns and breaks up readily and forms a good seed bed. It dries out fairly quickly after floods and heavy rains, but is boggy and sticky when wet. The soil on drying crumbles into small aggregates, locally called " buckshot."

Land of this type sells for $100 to $200 or more an acre, depending on location with respect to markets, improvements, condition with regard to overflow, and area under cultivation.

FRIO FINE SANDY LOAM.

The soil of the Frio fine sandy loam consists of a grayish-brown to brown fine sandy loam, which may extend throughout the 3-foot section or may be underlain at depths ranging from about 8 to 18 inches by a subsoil that varies in texture from fine sandy loam to silty clay, normally of light-brown, yellowish-brown, brownish-gray, or gray color, though in a few areas it may have a distinctly reddish cast. In the virgin state the soil is generally dark grayish brown. Both soil and subsoil are generally high in lime.

This type occurs in large bodies along the West Fork of the Trinity River and most of the larger creeks of the area, and its total extent in the county is considerable. The type is a first-bottom soil, subject to overflow, and is derived from sediments carried from the Grand Prairie and the West and East Cross Timbers Provinces.

In its virgin condition the type is covered by a forest consisting largely of hackberry, elm, pecan, cottonwood, and locust, with an undergrowth of shrubs and vines. Probably the greater part of the type is still unimproved.

Cotton and corn are the chief crops. The time of their planting depends on the subsidence of the spring floods, and this causes more or less delay. Cotton is subject to greater damage by the boll weevil than on upland soils, because of later planting. It produces from one-fourth to one-half bale per acre, or slightly more in seasons when the weevil is not especially active. Corn produces from 25 to 50 bushels per acre. Pecans are a source of income on this type. In many localities the trees other than pecan have been cleared out, and the ground cultivated, resulting in an increased yield and quality of nuts. Very large trees are found in the bottoms, and some of these yield nearly every year. The nuts bring from 15 to 35 cents per pound in the local markets according to size and quality.

Land of this type is held at $50 to $125 or more an acre, depending on location, position with respect to overflow, and value of timber.

FRIO LOAM.

The surface soil of the Frio loam consists of 8 to 12 inches of dark-gray, dark grayish brown, or grayish-brown loam. The subsoil is a grayish-brown to brown or gray clay loam or clay. Locally this grades at 30 inches into a gray stiff clay mottled with yellowish brown. Both soil and subsoil are calcareous. Lenses or layers of fine sand or fine sandy loam are encountered in places within the

3-foot section, and in spots the surface soil has a texture nearer a fine sandy loam than a loam. In the area near Hurst there are some slight elevations in which the material is similar to the Amite fine sandy loam, though occupying a distinctly first-bottom position. This variation was included with the Frio loam on account of its small extent. Some included areas have a silt loam surface.

The Frio loam occupies first bottoms along the major streams of the county, the chief area occurring along Village Creek. The type is subject to overflow.

Virgin areas of the type are in forest, consisting principally of the trees mentioned in the description of the Frio fine sandy loam. About one-half of the type is in cultivation, and is devoted chiefly to cotton and corn. Yields are about the same as on the Frio fine sandy loam.

FRIO CLAY.

The Frio clay consists of a dark-brown, brown, or grayish-brown silty clay, passing into a subsoil of brown, light-brown, or grayish-brown, stiff, heavy silty clay. In places the lower subsoil is a gray stiff clay, mottled with rusty brown and carrying oxide of iron concretions, the change from upper to lower subsoil being gradual. In virgin areas the surface layer, 2 or 3 inches thick, in places is very dark brown to black, owing to a high content of organic matter. Both soil and subsoil are calcareous.

In Tarrant County the type as mapped includes some black Trinity material, occurring either as layers of black clay through the 3-foot section, or as small individual areas of typical Trinity clay. In places the soil section includes sandy strata. As a whole, however, the type is rather uniform.

The Frio clay occurs in the first bottoms of the larger streams of the county, and is mapped in rather extensive areas, especially west of Fort Worth along both forks of the Trinity River. The type is formed from sediments derived from the Grand Prairie uplands.

On account of its subjection to periodic overflow, only a relatively small proportion of the type is under cultivation. In its virgin condition it is in forest, mainly of hackberry, elm, pecan, and locust, generally with a thick undergrowth of young shrubs and smilax vines. The forest areas are used for pasture.

The land under cultivation is utilized mainly in growing cotton and corn. The seed bed is prepared and the planting is done after the spring floods and it is sometimes as late as June 15 to July 1 before the crops are in. In ordinary seasons crops planted as late as this will mature before frost, but cotton is exposed to greater damage by the boll weevil than upon soils where early planting is possible. Cotton yields from one-fourth to three-fourths bale per acre on this soil when damage by the boll weevil is light, and corn yields from 35 to 50 bushels or more. The type is valued at $50 to $125 or more an acre for farming.

This is a strong, productive soil. Though plastic when wet, it crumbles if plowed when moderately moist. The straightening of the streams and the removal of trees and other débris from their channels would make the type less subject to overflow. Diking would reclaim a large area of the type for profitable crop production.

CATALPA CLAY.

The Catalpa clay consists of a dark-brown to brown silty clay, which either extends to depths of 36 inches or passes at about 15 inches into dark brownish gray to gray silty clay. The lower subsoil in places is faintly mottled with rusty brown and light gray or yellow. Some areas are included in which the subsoil is a gray to brownish-gray sandy loam, loam, and silty clay loam.

This type is developed in the first bottoms of streams issuing from the Black Prairie in the eastern part of the county. It represents the brown correlative of the Trinity clay. Its total area in Tarrant County is small.

The type is subject to overflow and not much of it is under cultivation. Cotton and corn are the chief crops, and the yields are said to be good. The uncultivated areas are forested with pecan, elm, and hackberry, support a good grass growth, and are used for pasture.

OCHLOCKONEE FINE SANDY LOAM.

The Ochlockonee fine sandy loam, as mapped in Tarrant County, includes a variety of first-bottom soils. The surface soil is chiefly a fine sandy loam, though ranging in texture from loamy fine sand to loam, and in color from gray to brown or dark brown. The soil varies in depth from about 10 to 36 inches or more, but as a rule it grades below these depths into brown to light-brown silty clay or clay loam. The subsoil generally contains lenses or layers of fine sand and fine sandy loam or layers of gravel. The material is mainly noncalcareous.

This is a first-bottom soil, subject to overflow. It is formed from sediments washed from the adjacent East Cross Timbers uplands by the streams along which it occurs. The type is mapped along the upper reaches of the smaller streams. It is chiefly in forest consisting largely of hackberry, sycamore, cottonwood, and elm, and very little of it is under cultivation.

ROUGH STONY LAND.

Rough stony land, as mapped in Tarrant County, comprises two classes of material—(1) that occurring on the Fort Worth Prairie and (2) that occurring in the sandy Cross Timbers formations. In the former it consists of the severely eroded areas of Fort Worth limestone, including numerous escarpments, and the topography is strongly rolling to rough and steep. The fine material consists of Denton soil. The land is rough and rocky, and in places is without vegetation. Mesquite trees grow here and there. The grass is generally mesquite grass. In the sandy Cross Timbers belts the land is also rough, eroded, and steeply sloping, but not generally so stony. It is covered with a growth of stunted oak, mainly blackjack oak and post oak, with Bermuda grass in the areas where trees are not too thick.

The chief occurrence of this land is along the slopes from the uplands and terraces to the bottoms of the forks of the Trinity River and their larger branches. The total area is relatively small. The only use of the type is for pastures and woodland.

SUMMARY.

Tarrant County lies in northeastern Texas, in the third tier of counties south of Red River. It has a land area of 884 square miles.

The topography of the county varies from nearly level to rolling, with a small area of rough land adjacent to stream valleys. The general slope of the county is toward the east and southeast. Altitudes vary from 450 feet to 1,050 feet above sea level.

Four distinct physiographic divisions occur in the upland, the Black Prairie, Grand or Fort Worth Prairie, East Cross Timbers, and West Cross Timbers.

Drainage is effected through the Trinity River, by its two branches, the West and Clear Forks, and a number of prominent and minor local drainage ways. Good drainage prevails throughout the county.

The population of Tarrant County in 1920 was 152,800. Fort worth is the principal city, with a population of 106,482. Other towns in the county are Arlington, Grapevine, and Mansfield. Small trading points are scattered through the county. Schools, churches, and cotton gins are located at convenient points. The educational system of Fort Worth includes several institutions of higher learning. Telephone systems and rural free delivery mail routes reach all sections. The public road system includes a considerable mileage of asphalt roads and graveled roads. Fort Worth is a railroad center and the principal livestock market in Texas.

The climate of Tarrant County is mild and healthful. The annual mean temperature is 65° F., with an absolute maximum of 112° F. and an absolute minimum of —8° F. Average annual precipitation is 26.89 inches. The average growing season is 254 days.

The agriculture of Tarrant County consists principally of cotton production. Corn, oats, and wheat, and forage crops are grown for local use. Some broomcorn is grown in the eastern part of the county. In the vicinity of Fort Worth and between Fort Worth and Dallas considerable trucking and dairying is done. Watermelons, muskmelons, blackberries, and dewberries are important products in this section. In the western part of the county some cattle and sheep are raised.

Parts of three soil provinces are represented in Tarrant County—the Atlantic and Gulf Coastal Plain, the Great Plains, and the River Flood Plains. The Coastal Plain includes the Black Prairie and East Cross Timbers, the Great Plains includes the Grand Prairie (Fort Worth Prairie) and West Cross Timbers, and the River Flood Plains include the high terraces, terraces, and first bottoms along the streams of the county.

The upland soils are residual, being derived in the Black Prairie and Grand Prairie from fine calcareous shales, marls, and limestone, and in the East and West Cross Timbers from more or less consolidated deposits of arenaceous clays, sandstone, and ironstone.

The high terraces are of alluvial and alluvio-colluvial formation, and the terraces and first bottoms are of comparatively recent alluvial deposition.

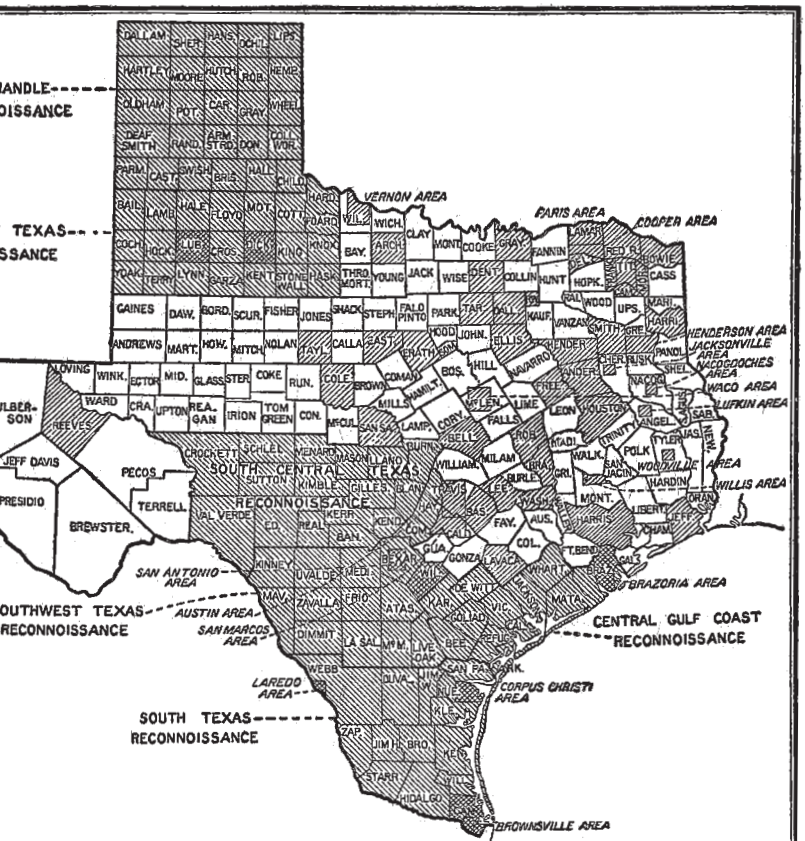
The Black Prairie soils are included in the Houston series. The soils of the Grand Prairie belong to the Denton, Crawford, San Saba,

Durant, and Wilson series. In the East Cross Timbers region the Kirvin soils predominate, while the Tabor, Lufkin, and Norfolk soils are also found. The Windthorst and Nimrod soils occur in the West Cross Timbers.

The high terraces have weathered into the Lewisville, Bell, and Irving soils, and the lower terraces are occupied by soils of the Amite, Kalmia, Leaf, and Simmons series. The first-bottom soils in Tarrant County include the types of the Trinity, Frio, Ochlockonee, and Catalpa.

A small area of Ellis clay is mapped in the southeastern part of the county on the escarpment from the Austin chalk to the Mountain Creek bottoms. Some Rough stony land occurs in the county, chiefly along the slopes from the upland to the drainage ways.

○



Areas surveyed in Texas, shown by shading

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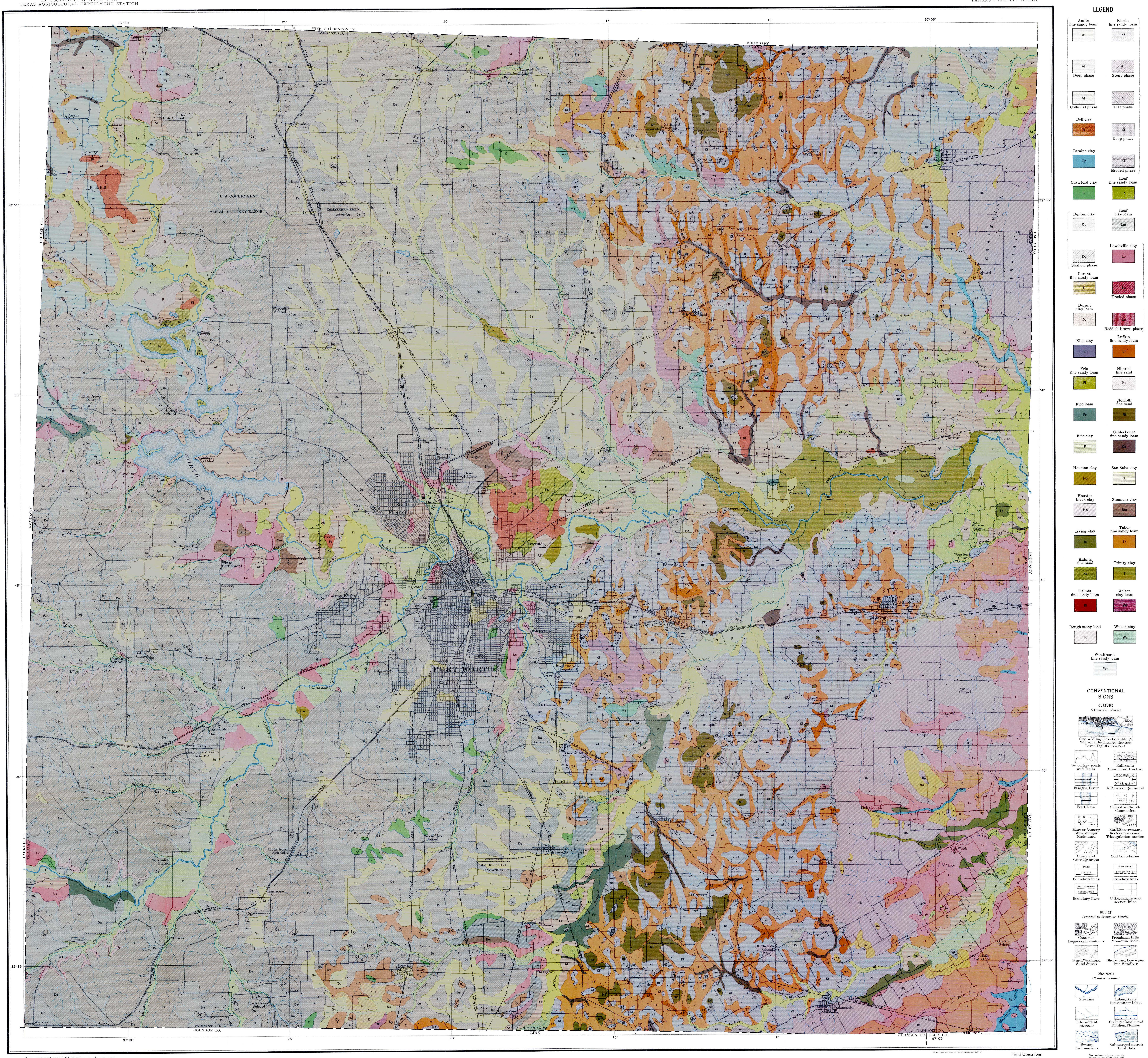
BUREAU OF SOILS
IN COOPERATION WITH THE
TEXAS AGRICULTURAL EXPERIMENT STATION

SOIL MAP

TEXAS
TARRANT COUNTY SHEET



97°30′
25′
20′
15′
10′
97°05′
32°55′
50′
45′
40′
32°35′
WISE CO. | DENTON CO.
TARRANT CO.
BOUNDARY LINE
TARRANT CO.
JOHNSON CO.
JOHNSON CO. | ELLIS CO.
U S GOVERNMENT
AERIAL GUNNERY RANGE
FORT WORTH
LEGEND
Amite fine sandy loam
Af
Deep phase
Colluvial phase
Kirvin fine sandy loam
Kf
Stony phase
Flat phase
Deep phase
Eroded phase
Bell clay
B
Catalpa clay
Cy
Crawford clay
C
Leaf fine sandy loam
Ls
Denton clay
Dc
Shallow phase
Leaf clay loam
Lm
Lewisville clay
Lc
Eroded phase
Reddish-brown phase
Durant fine sandy loam
D
Durant clay loam
Dy
Ellis clay
E
Lufkin fine sandy loam
Lf
Frio fine sandy loam
Fl
Nimrod fine sand
Ns
Frio loam
Fr
Norfolk fine sand
Nf
Frio clay
F
Ochlockonee fine sandy loam
Os
Houston clay
Hc
San Saba clay
Sc
Houston black clay
Hb
Simmons clay
Sm
Irving clay
Ic
Tabor fine sandy loam
Tf
Kalmia fine sand
Ks
Trinity clay
T
Kalmia fine sandy loam
Kl
Wilson clay loam
Wl
Rough stony land
R
Wilson clay
Wc
Windthorst fine sandy loam
Wt
CONVENTIONAL SIGNS
CULTURE
(Printed in black)
RELIEF
DRAINAGE

Soils surveyed by H. W. Hawker, in charge, and
Neal Gearreald of the Texas Agricultural Experiment
Station and M. W. Beck of the U. S. Department of Agriculture.

Scale 1 inch - 1 mile

Field Operations
Bureau of Soils
1920